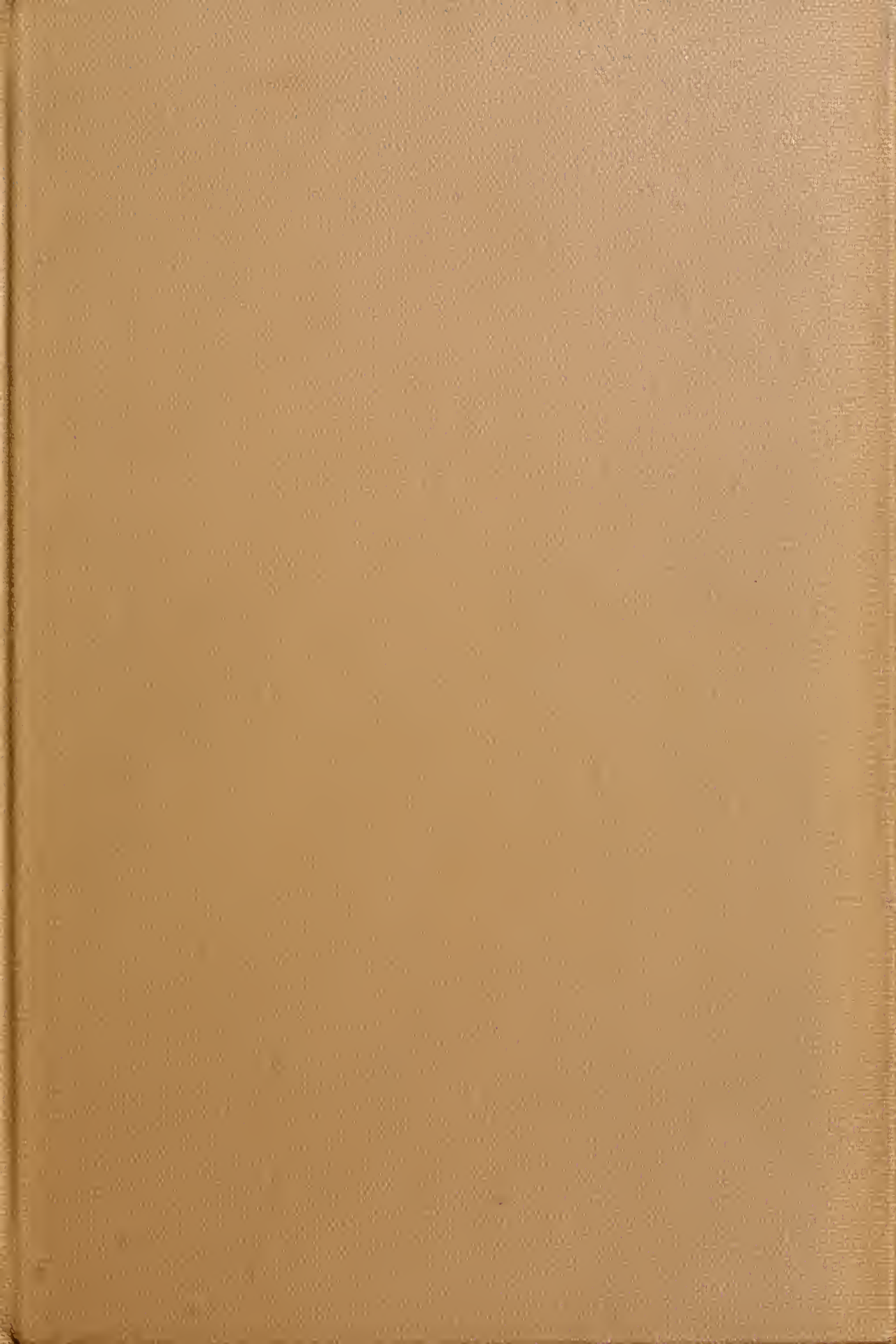




THE CANADIAN FIELD NATURALIST



OTTAWA FIELD NATURALISTS' CLUB

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THE CANADIAN FIELD-NATURALIST

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THE CANADIAN FIELD-NATURALIST

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No. 1.

FAUNAL NOTES FROM THE ATLANTIC BIOLOGICAL STATION (1920.)

By A. WILLEY and A. G. HUNTSMAN.

Owing to its geographical situation, Passamaquoddy bay occupies a critical position between the Gulf of Maine and the Bay of Fundy; its herring and pollock fisheries give it a definite standing as a fishing ground; and the Biological Station makes it a centre of research. In view of these circumstances and for other reasons which could be but need not be mentioned here, we thought it desirable to put on record some of the more salient of the occasional observations, having no relation to the main business of the station, which came to our notice during the summer of 1920. We found for example indications that when a group of animals has been treated monographically, members of that group that have not been mentioned in the monographs will nevertheless make their appearance in the bay. And their presence in the bay is at least as interesting as is their mention in a monograph.

Not all the records which follow are those of fugitive species, but great importance should be assigned to the latter because of their relation to the prevailing currents. It is sometimes assumed that permanent residents are more valuable than transitory vagrants. This is true for commercial exploitation but not for scientific interpretation. And the Biological Station may be said to exist for the purpose of effecting the reconciliation between science and commerce in fishery matters. In such a sense we believe that these notes are worth the trouble that has been involved in making the identifications.

Every bay has something out of the ordinary to offer every year, but it is rarely that the opportunity arises for the exceptional events to be authenticated.

Gellius arcoferus Vosmaer (Figure 1).

An example of this siliceous sponge, two feet in diameter, was obtained in the

shrimp trawl on June 23rd, 1920, at "Prince" station No. 4, in Passamaquoddy bay, at a depth of 25 metres on a muddy bottom. From the standpoint of systematic zoology it was the most notable trophy of the season. It is a circular mat-like sponge and it is proposed to call it the "mat-sponge"; only about half of the circle was secured. It is one of Vosmaer's Arctic sponges, named by him in 1885 from material obtained by the Willem Barents Expedition (1880-1881) in the Barents Sea between 72° and 77° north latitude and between 24° and 50° east longitude, from depths of 140 to 170 fathoms. All the specimens at his disposal were fragments, flat pieces indicating, as he thought, that the original shape was probably that of a fan. Two examples of the same species were dredged up by the Swedish (Vega) Arctic expeditions, one of which was cake-like and circular, 90 mm. in diameter. These were described by Fristedt in 1887; one from Lat. 76° 52' N., Long. 116° E., 36 fathoms; the other from Lat. 59° 33' N., Long. 43° 28' W., south of Greenland, 120 fathoms.

Lastly a few examples, dredged by Mr. J. F. Whiteaves in 1872 in the Gulf of St. Lawrence off Cape Gaspé and Cap des Rosiers, 75 to 80 fathoms, were described by Lawrence M. Lambe in 1896 in the Transactions of the Royal Society of Canada for that year. These were all flat, about 18 mm. thick, and as much as 120 mm. across. Thus the sponge obtained last year at the Biological Station was much larger than any previously recorded in that species, and illustrates very well the pronounced Arctic element in the fauna of Passamaquoddy bay. Such an expanse of canal-system as this species presents must exert a profound influence upon the circulating pabulum of its environment and so play an economic rôle not less important because unperceived.

Staurophora mertensii Brandt.

This is the only large Hydromedusan of the bay. It attains a diameter of as much as 20 centimetres, and is a conspicuous object with a very distinct cross, formed by the extension of the lobes of the mouth from the centre of the animal along the four radial canals well toward the margin. In the summer of 1910 it was observed commonly in the channels leading into the bay as well as elsewhere in the vicinity. In 1912 it was observed floating in the bay and stranded on the shore at St. Andrews.

bay, appearing regularly every spring and being so abundant during the summer as to clog the plankton nets. *Cyanea*, on the other hand, is rare and comes into the bay only periodically. For several years it has been very rare or absent altogether, but during this past summer (1920) it has been fairly common. It did not make its appearance, however, before July, and it had quite evidently been brought in by currents from its home in outer waters. The sea anemone, *Peachia parasitica* Verr., that lives fastened to it, was found this



Fig. 1. — *Gellius arcoferus*, the mat-sponge, from a photograph (A.G.H.).

Since then it has not been seen until July and August of this year (1920), when it was found very generally in the passages leading to the bay, in the bay itself, and also in the tributary waters of the Magaguadavic and St. Croix rivers and St. Andrews harbour.

Cyanea capillata, var. *arctica* Per. et Les.

This arctic form is the large red jellyfish that occurs commonly in the Gulf of St. Lawrence. *Aurelia flavidula* Per. et Les., our other Scyphozoan medusa, is a constant inhabitant of Passamaquoddy

year attached to large specimens just as when *Cyanea* was abundant a number of years ago. In that year (1913) young haddock (*Melanogrammus*) about 5 cm. long were found living commensally with the *Cyanea*, one or two of the fishes being taken from each large jellyfish.

Polydora ciliata (Johnston 1838).

This tubiculous annelid worm is no rarity, but its zoogeographical value is great, being almost cosmopolitan in distribution. It occurs all round the British islands; Spitsbergen; Scandinavia; coast

of France; Mediterranean and Black Sea; Atlantic coast of the United States, including the Woods Hole region; Australia and the Philippine islands. Its important synonyms are *P. agassizii* Claparede 1868, and *P. littorea* Verrill 1873.

On the shore between the Biological Station and Joe's point at low tide it is very abundant on the shells of the living whelk, *Buccinum undatum*. The free-swimming larvae are quite common in the bay, thus swelling the nutritive value of the plankton. The mud-tubes of the worms project from openings in the surface of the shell and when they are cleaned away the latter is found to be eroded with vermiform grooves. Often the worms are not buried in the shell but lie in its furrows, and they occur also elsewhere in the muddy crevices of rocks. They are not found at or near the mouth of the shell. The same species causes the so-called "worm-disease of oysters" in New South Wales (Whitelegge) and in the Mediterranean (Carrazzi), but when it infests oyster beds it attaches itself at the margin of the valves where it causes eventually a fatal accumulation of mud. Another species has been found in company with *P. eiliata*, namely, *P. hoplura*, which actually excavates galleries in the shell of oysters, but it is not certain whether this is effected by mechanical or chemical means. It is possible that *P. hoplura* may also occur at St. Andrews but it has not been recorded yet.

In frequenting the shell of such an active gastropod as the whelk, the *Polydora* derives advantage from its mobility, like *Hydraetinia* which commonly selects shells occupied by Hermit Crabs but has been found upon the shell of a living *Buccinum undatum* at Woods Hole, as well as upon rocks and piles. The frequency of the occurrence of *Polydora* upon *Buccinum* at St. Andrews entitles it to the local appellation of "whelk-worm."

Lepas hillii Leach.

No *Lepadidae* are native to the bay, such as do occur being found only on drifting wood that has been brought in more or less casually from the warm waters of the Gulf Stream, where the genus *Lepas* occurs commonly in several species. There is no regularity in their entrance into the bay. In

1912 a block of wood with a large number of *Lepas hillii* attached and well perforated by the shipworm, *Teredo*, which is also an alien here, was brought to the Station by fishermen, who had found it floating beside a weir near St. Andrews. On August 17th of the present year there were sent to the Station specimens of the same species that had been taken by a fisherman from a floating lobster pot near the mouth of Kitty Cove. In both cases the fishermen considered these animals as something quite new and unheard of, which indicates their great rarity here.

Idothea metallica Bosc.

When the late Mr. N. A. Wallace was making his study of the Isopods of the Bay of Fundy (recently published) in the years 1912 and 1913, he did not find this species. Last summer (1919) during the investigation of St. Mary bay on the coast of Nova Scotia by the Biological Vessel "Prince", Dr. Philip Cox found a single specimen of this form in the bay. Subsequently we obtained a number of individuals from floating seaweed on our way across the Bay of Fundy. A large individual was taken in the St. Croix river from the wharf of the Biological Station by Dr. F. S. Jackson in July of the present year. This species is an inhabitant of the Gulf Stream, where it occurs on floating Sargasso weed. It does not properly belong to our coast, its presence indicating some drift in to the coast from the waters of the Gulf Stream.

Cancer borealis Stimpson.

The common crab of the bay is *Cancer irroratus* Say, the rock crab, which is to be found nearly everywhere on sandy and gravelly or stony bottoms from low-water mark out into deep water. At the mouth of the bay on rocky shores exposed to the waves of the Bay of Fundy the Jonah crab, *Cancer borealis*, is to be found quite regularly in small rock pools and in crevices. This latter species is about the same size as the rock crab (up to 12 or 13 cm.) but is rougher and more strongly built. In the St. Croix river in the vicinity of the Station dead individuals have been found on two occasions, namely in 1913 and again during the present summer. It was a matter, therefore, of considerable interest

to find among the crabs brought in during August from the lobster traps that were being fished in about five fathoms of water near the Station, two fine living specimens of the Jonah crab. These were easily kept for some time in an aquarium in the laboratory. Both were abnormal in having dark markings on the carapace, the black colour being like that of a metallic sulphide. The mud of the beach exhibits this colour where decomposition of much organic matters is going on. When one of the crabs was opened part of the digestive gland on the right side was found to be much altered, some of the tub-

more appropriate one, as it describes the unusual shape of the jaws that makes the mouth open dorsally. In 1910 when collecting at low tide on certain muddy flats near the mouth of the Magaguadavic river on the east side of the bay, holes an inch or more in diameter were noticed in the mud. Digging yielded no quarry from these retreats, but while we were tramping about in the mud a wrymouth suddenly appeared. Similar action at another set of holes yielded the same result. On June 21, 1920, while at the Magaguadavic river to study the success of the smelt spawning, the flats were visited at low tide, and four



Fig. 2.—The system of burrows of a wrymouth. From a sketch (A.G.H.).

ules being black and hardened, and of a horny consistency. It would seem that such individuals of the Jonah crab as come so far into the estuary as the St. Croix river are affected unfavorably, become diseased and die; also that they keep to deep water rather than entering the intertidal zone.

Cryptacanthodes maculatus, Storer.

Advantage was taken of an opportunity for making observations on this curious and little known fish, that has been given in English the names of Wrymouth and Ghostfish. The former name seems the

wrymouth secured, all more than 40 cm. long, that is, nearly full grown.

The burrows in which the fishes were living were found in very soft mud from the lower part of the *Fucus* zone downward, that is as far up as four feet above low water mark. Those at the highest level were in shallow tide-pools and the others in such flat situations as prevented them from ever being drained of water. Each system of burrows, inhabited by only one fish, consisted of branching tunnels about 5 cm. in diameter, and from 3 to 8 cm. below the surface. These tunnels to a certain extent radiated from a somewhat cen-

trally placed low mound about 60 em. in diameter and 5 em. high. In the centre of this mound was a broad funnel-shaped depression leading into the main entrance of the system of burrows. Scattered for some distance around the mound, within a circle with a radius of from three to five feet or even more, and opening from the burrows, were a number of holes of the same diameter, their margins being flush with the surface of the mud. One system was traced out by opening up all the burrows. It is represented in figure 2. It will be seen that this system is not very regular, and shows a development of the burrows almost wholly on one side of the mound. Most of the branches open to the surface, but some end blindly. The openings are to be found not only at the ends of the

the laboratory, in a flat, shallow tank provided with running salt water. They were heard making a very considerable commotion in the late afternoon and evening, and on the next morning one was found dead on the floor. On the following morning another was found dead. Boards were then fastened around the edge of the tank, and the remaining fish was kept without difficulty through the season.

This individual, which was about 45 em. in length, was a male, judging from the examination made of the others. On June 24th, a piece of black, hard rubber pipe, $1\frac{7}{8}$ inches outside diameter, $1\frac{3}{8}$ inches inside diameter, and 8 inches long, was placed in the tank. After a time the fish entered the pipe and took up a resting position with both ends protruding,



Fig. 3.—Wrymouth reclining in a tube in the aquarium. Sketched from a photograph (A.G.H.).

branches, but also at the junctions and along the course of the branches.

The fish were found to emerge, not from the main opening in the mound, but from one of the other openings, which shows that they were pointing away from the mound. We suppose that the mound opening is the point from which the burrows were formed, that the mode of formation was the thrusting of the animal's head through the soft mud, and that the other openings are necessary for the indraught of fresh water in breathing. Its method of bringing fresh water into its burrow, to be described later, is such as to cause a current to flow from the peripheral openings toward the centrally placed entrance, and from this current is doubtless deposited the material that forms the mound.

Three of the wrymouths were placed in

but with more of the head than of the tail exposed (Figure 3). Later the head was drawn back until just concealed. The pipe rolled somewhat when the fish moved, and finally the fish left the pipe. The latter was then steadied with stones, and, when the fish again entered, it was not readily abandoned.

Locomotion.—Forward movements were accomplished by means of undulatory lateral motions of the tail and posterior part of the trunk well forward to the head, the dorsal fin of that part being kept erect. Backward movements were accomplished by pressing the tail or part of the trunk forward against objects, and by placing the pectoral fins on the bottom and turning them forwards. In forward and backward movements the median (dorsal and anal) fins were kept flexed except as men-

tioned above. A stimulation of the skin of the side by touch caused the animal to move forward when applied near the tail, and to move backward when applied farther forward.

Respiration.—Occasionally the fish retreated to a position with about one quarter of the anterior end protruding, and with the ventral parts of the pectoral fins bent back and applied to the bottom. The head and pectoral fins remained stationary, and the remainder of the body performed undulatory motions, two complete waves being observed on the fish at any one moment. The dorsal fin preceded the body slightly in the lateral movement. That a current was made to flow through the pipe was demonstrated by dropping some carmine, suspended in water, near the head of the fish. The carmine particles were drawn into the pipe. Other particles were carried alongside the pipe and past the other end. No carmine particles were observed to issue from that end, probably because of dispersion of the particles into a larger volume of water, and because the movement soon ceased. The fish seemed to be irritated to some extent by the particles. The movement lasted for from one to two minutes. On one occasion the movement was observed being carried out by the fish when it was not in the tube, but in a corner of the tank with its head against the end wall.

The respirations numbered from 12 to 20 per minute. When the animal was approached it ceased breathing for from one to two minutes. At the conclusion of this period of rest, it would either give two or three deep inspiratory gasps, opening its mouth widely, or would merely resume breathing at a somewhat more rapid rate than usual. Occasionally on resumption of breathing the lateral undulatory movements would be commenced, the anterior part of the body remaining stationary. There can be little doubt that these movements are initiated by dyspnoeic conditions, and that they are for the purpose of renewing the water in the burrows in which the fish lives.

Feeding.—The stomachs of specimens that were opened shortly after being caught contained beach fleas, or scuds, (*Gammarus locusta*), sand shrimp, (*C. ago*

septemspinus), and fragments of flounder, (*Pseudopleuronectes americanus*). The specimen kept in the tank took food freely. It usually left its tube in the late afternoon, and could be heard at dusk thrashing around in the water. Scuds placed in the tank disappeared, as did also hermit crabs (*Pagurus acadianus*). It also took, when offered, small herring or sardines, limpets, periwinkles, whelks, clams, and mussels. These it would take from the hand, even reaching out of the water to seize them, and approaching from a distance of as much as a foot. Sight seemed to be as important as smell in determining its feeding, as it would show excitement by moving its tail and lifting its head, and finally move forward and snap with its jaws when the finger was held just above the surface of the water in front of it. Not only was the food seized, but also there was a strong indraught of water into the mouth that carried the food along. When the feeding was done at the surface of the water, air also was drawn in, producing the sound so characteristic of the last stages in pumping the bilge water out of a boat, when the water is mixed with air. The dorsal position of the mouth is favourable to the taking of food from above, which is perhaps the normal method with this fish. At times, however, it was seen to turn on its side in order to seize food lying on the bottom of the tank. Food taken into the mouth was either rejected or swallowed by a series of vigorous peristaltic movements of the mouth and throat. To swallow a very large piece might require considerable time, and might even result in the fish coming out of its tube for more freedom, and turning all the way over once or twice in its swallowing efforts.

Zoarces anguillar (Peck).

A muttonfish 45 cm. in length was kept in one of the flat tanks of the laboratory during the latter half of the season and proved to be quite hardy. It fed regularly on the fish and shell-fish given it, approaching from a distance of more than a foot to take food from the hand. The enormous thick lips were used more than the teeth for taking hold of the morsels and a strong inspiration of water carried the food in. Swallowing did not immediately follow the taking of food, but was

preceded by a rather prolonged series of masticatory movements involving both mouth and throat, and in which the head was nodded vigorously by movements in the vertical plane, the downward ones being the more vigorous.

The enormous pectoral fins were used in slow backward and forward locomotion, each fin being kept in a vertical position and slightly folded with the convex side in the direction of movement. At rest each fin is held out from the body almost in the horizontal plane and against the bottom, with the dorsal part posteriorly placed and somewhat raised. Rapid swim-

ming is accomplished by undulatory movements of the posterior part of the trunk and tail; the pectoral fins being extended to the fullest extent and held horizontally with the dorsal edge in front, while the dorsal and anal fins are kept close to the body, at least anteriorly.

Touching the side of the trunk or tail resulted in the erection of the dorsal fin. After repeated stimulation the response became rather local, extending both forward and backward from the level of the point touched, but chiefly backward. At the same time the fin was bent toward the side stimulated.

THE LIARD RIVER FLOOD OF JULY 1919.¹

BY E. J. WHITTAKER.

In a recent issue of the *Geographical Review*² Dr. E. M. Kindle states that the Liard is the main source of supply of driftwood for the Mackenzie River, and that "the unusually high stage which the Liard reached in 1919 set afloat a vast quantity of stranded logs, many of which had started their northern journey in previous years." In view of the fact that this flood was unprecedented within the memories of the present inhabitants of the region, and also that the writer was ascending the Liard during the period of maximum flood conditions, the following observations are presented which may be of interest to readers of this publication.

After a quick trip from Edmonton the Geological Survey party to which the writer was attached reached Fort Simpson, N.W.T., on July 1st, 1919. This fort is situated on an island at the junction of the Liard and Mackenzie Rivers, and at no other point is there a more striking view of the width and volume of this northern waterway. Upon enquiry we were told that the flood stage of the river had reached its maximum about three days before, and had now fallen four feet below the high water mark. The following day, Wednesday, July 2, we commenced track-

ing up the Liard. Owing to the high water, travel was not easy, yet we hoped it would steadily improve as the river level lowered. It did actually lower until Saturday afternoon, July 5th, during which time we reached and passed the long series of rapids about thirty miles above Fort Simpson. We camped that evening on the shore opposite the lower end of Gros Cap Island, at the upper end of the canyon. During the afternoon a slight increase in the quantity of driftwood warned us that the river was once more rising. All day Sunday it rose slowly but steadily, ten inches in the twenty-four hours.

About midnight of the 6th, the noise of the water and the grinding and breaking of trees increased perceptibly. The river became quickly covered with driftwood from bank to bank and encroached rapidly upon our camp site, which had been selected for convenience rather than with an eye to floods. This site had to be abandoned. As high ground was a long distance back through a dense forest and it was now impossible to go upstream against the driftwood laden waters, which were already undermining and dropping trees into the river, we went carefully downstream three miles to Poplar river, where a bank 250 ft. high made certain that we could retreat as high as necessary, and the dead water at the mouth of the smaller stream made a secure harbour for the canoe.

We remained at this camp 4 days, dur-

¹Published by permission of the Director of the Geological Survey of Canada.

²Kindle, E. M., "Mackenzie River Driftwood", *Geographical Review*, Vol. XI, January, 1921, No. 1, pp. 50-53.

ing which the rapids on the Poplar River above its mouth were drowned out one by one as the rising Liard backed its waters higher up. By this time the larger river was full of sediment and for drinking water we had to go farther up the Poplar, whose clear reddish waters were much more palatable. A large boulder which had been noted on the upward journey was selected as a gauge and then corresponding marks were cut on the bank. The waters rose at this point over seventeen feet in sixty hours. Unfortunately some pictures which were taken of the changed appearance of the banks were ruined by the damp weather, as the moisture penetrated even so-called waterproof tins. A conspicuous flat island at the mouth of the Poplar with a steep bank about ten feet high was completely submerged and at the height of the flood only the tops of its small spruces were to be seen. In traversing the neighbourhood, the sound of rushing river water was heard in some places a quarter of a mile and more from the river bank, while the forest was being denuded of its fallen trees and its underbrush was being flattened. On the opposite side of the river where the shore was a cut bank of till, great cracks appeared in the cliff resulting in huge long masses weighing hundreds of tons becoming undercut and detached; these fell into the river from time to time with a noise that rose even above that of the water and caused great waves which came, in spite of the driftwood, across the river to our camp.

The high water mark of the flood was reached at 3 p.m., Thursday, July 10th, and after remaining at this level for four hours, began to recede. At this time the waters were eighteen feet above ordinary high water mark. This part of the river, however, was narrow, and the waters piled up more than in the wider sections.

As soon as we were able to travel we started upstream once more and found that the banks had suffered considerably. Everywhere they had been cut back for many yards and were a mass of twisted and gnarled trees. Out in the current hundreds of trees which still were fastened to the land by their roots, swaying and twisting, were given, where possible, a wide berth by the canoe. Their numbers were

increased at intervals by other trees falling into the river. Camp spots were difficult to find as the shore could only be gained at intervals owing to the above conditions, and even when we were ashore everything was covered with about six inches of soft black mud, newly deposited by the river. This latter condition was most noticeable in the "Long Reach", where the river is over a mile wide with low banks of sand and clay. There was one small point where over eight feet of sand had been deposited. Trees were dragging by their roots one hundred feet out from the cut bank, which had thus been cut back for at least that distance. At one spot at the junction of the Liard and Nahanni Rivers where there were several old Indian cabins, erosion had exposed what was apparently the ancient remains of a rude coffin. It may be said that although the river dropped slowly, it remained very high all summer, and had the Forts Liard and Nelson been obliged to depend for provisions, as in previous years, on scows brought up by trackers, they would have been late in receiving them. It was not till September, when the sandbars began to be exposed, that such transportation could have been attempted. Fortunately the new steamer of the Hudson's Bay Company was able to reach these forts in the latter half of July.

That the flood of the Liard in 1919 was unusual the following facts will show. The Hudson's Bay Company had cut wood the previous winter all along the river for their new steamer. According to Captain Mills not a single wood pile remained, and the crew had to cut their own fuel at all times. Several buildings at Fort Liard which were almost as old as the fort itself were undercut and destroyed. Ancient log jams which had withstood the ice and floods of many previous years were entirely removed. At the junction of the Liard and Nahanni, and also up the latter stream, were two gardens and cabins of a trapper called LaFleur. Both his potatoes and house were submerged. In many cases the shore, which had been of a mature type with grass-covered gentle slopes on which were very old Indian camp sites, was converted into high steep cut banks.

Dr. Kindle in the article previously

quoted states "The vanguard of the main volume of the Liard driftwood reached Old Fort Good Hope on the Lower Mackenzie about July 13th". This vanguard reached our camp on the Liard at Gros Cap Island about midnight of July 6th. The driftwood therefore required at most about seven days to travel the distance between these two points, which is approximately 620 miles. This means that it was transported at an average rate of at least three and three-quarters miles an hour, and gives a good idea of the swift current of the Mackenzie.

The flood was caused by unusually warm and abundant rains throughout the basin

of the Liard. This river rises in and drains a large area west of the main range of the Rockies between latitudes 58 deg. and 61 deg. 30 min. N. and then cuts through this range to the eastward. The warm rains not only caused the rivers to rise by their own precipitation, but also rapidly melted the mountain snows. That the flood extended to its headwaters was shown by the large number of huge trees in the driftwood common in Northern British Columbia, but entirely unknown in the lower reaches of the river. We had only six dry days out of six weeks on our trip, which accounts for the continued high water all summer.

VANCOUVER NATURAL HISTORY SOCIETY. NATURALISTS STUDY ALPINE FLORA.

The ninth of a series of excursions held this summer by the Vancouver Natural History Society took place last week end when a party of 22 ladies and gentlemen left on Saturday to study the flora of Grouse, Dam and Goat Mountains. Amongst those present were several members of the University Summer School Botany Class which finished work the previous day, and this outing proved a fitting climax to a strenuous term of indoor lectures.

Under the leadership of the President, John Davidson, F.L.S., the party proceeded via Lonsdale, Mosquito Creek, where attention was directed to the devastating effect of erosion, which the President several years ago foretold would result if logging operations were carried on in that vicinity. It was pointed out that the people of N. Vancouver in future years will have to pay for the folly of the present generation in allowing erosion to commence through permitting a logging company to obtain a few thousand dollars worth of timber. Already trees, houses and bridges had been destroyed at this point and greater havoc is likely to take place within the next few years. Continuing, the party travelled via the B. C. Mountaineering Club's trail to the Club's Cabin, use of which had been kindly granted for the occasion. During this part of the journey attention was drawn to the changes in vegetation corresponding with the change in altitude. The trees and undergrowth at first were sim-

ilar to those found around Vancouver, the Giant Cedar, Sitka Spruce, Hemlock, and Douglas Fir, with undergrowth of Salal, Huckleberries (which are more abundant than usual this year), and False Azalea, while here and there were found patches of Pipsissewa, a native plant used for medicinal purposes. Higher up, near the 2,000 ft. altitude, Western White Pine with its long cones and leaves in clusters of five became frequent, and occasional trees of Yellow Cedar and Western Yew were observed, the latter with its beautiful red berry-like fruits in evidence.

Dinner past, the evening was spent inspecting a collection of pressed plants prepared by one of the members who had recently returned from a trip through the drybelt. By this time, in spite of the light smoke screen which hung over the inlet, the lights of Vancouver were in evidence and the party spent half an hour picking out the various sections and streets of the city; motor cars and inter-urban trains were discernible by their strong head lights.

By half past six the following morning the cabin was astir, some getting breakfast ready, others packing supplies for lunch, while novices looked on with interest at how things were done by mountaineers. Breakfast past the party was divided into two sections, one, under the leadership of the Society's treasurer, Mr. Jas. Lyall, taking the direct trail from the cabin to the Plateau of Grouse; the other, under the

leadership of the President, taking the longer and more arduous route up the bluffs via Larsen's trail, both parties to meet again at the summit of Grouse Mountain.

Soon after starting on the trail, no less than three different species of Club-mosses were found on the southern slopes at 2,300 ft. elevation. Descending to a valley 1,900 feet above sea level, the party found a great variety of ferns and flowering plants, the Cliff-brake Fern — often erroneously called Parsley Fern—the Oak Fern, Sword Fern, Deer Fern, or Rock Fern; the Goats-Beard, Ocean-Spray, several Saxifrages, two species of *Pentstemon* with beautiful purple flowers, Dwarf Salal and numerous other species which had flowered earlier in the season and were now in fruit. The trail zig-zags onward and upward over the ledges known as Eagle Bluffs, and on these ledges sufficient soil has accumulated to support a great variety of trees, shrubs and flowering plants. Wild Roses, Black-Caps, Huckleberries, Blueberries, and Blackberries were much in evidence, and here one noticed the gradual change from lowland trees to alpine species; the Western Hemlock and Giant Cedar of lower altitudes gave place to the Mountain Hemlock and Yellow Cedar, while the Western White Pine became common, the abundance of shed needles on the trail causing some anxiety to one or two members who had omitted to provide themselves with proper foot-wear. On reaching the plateau the party inspected the area affected by fire, and, satisfied that it was safe to proceed, continued the journey which had Goat Mountain as the objective. Here they were joined by three members who missed the ferry the previous day and who, not knowing the right trail, arrived at the plateau with a limited supply of provisions and utensils and spent the night in the open.

On the plateau and regions above the forest is chiefly Mountain Hemlock, Yellow Cedar, and Lovely Fir, the latter being often mistaken and cut for White Fir, which in this part of Canada is really the Grand Fir. The underbrush consists largely of White *Rhododendron* which was past its best, and the beautiful Copper-bush, while the ground is carpeted by the

so-called Heather, a very different plant from any of the Scotch species.

No time was spent on Grouse summit, the party continuing to the valley between Grouse and Dam Mountains where both parties joined and started the ascent of Dam together. Here on the east slopes were found many additional alpine species, some in flower, others in fruit, the *Arnica*, Mountain Flea-Bane, Grass of Parnassus, Mountain Dewberry, Rosy Twisted Stalk, and mountain Mare's Tail were found in flower, while False Hellebore, Marsh Marigold, the leathery Saxifrage, and other alpine plants were found in fruit.

In the midst of these flowers the company halted by a streamlet for lunch, and in a short time the "billies" were boiling and tea served to the members, who by this time were ready to forego their higher education in order to satisfy what seemed to be insatiable appetites. This done, all were ready to proceed to the summit of Dam mountain, 4,500 feet above sea level, where a photograph was taken of the party in order to have a record of the largest Natural History excursion to this point.

Thereafter eleven of the members proceeded to Goat Mountain. In former years the intervening ridge proved a profitable region for the botanist, but this year on account of the lightness of the winter's snowfall everything had so dried up that nothing was added to what had already been found. Even on Goat Mountain, where at this time of the year on former occasions large patches of snow were found, this year the snow had completely gone and the summit was as dry as the summit of Grouse. This year, however, the comparatively rare and interesting little Saxifrage known as Tolmie's Saxifrage was found in flower, whereas in previous years it was seen just emerging near the margin of the snow patches.

At three fifteen the party retraced their steps to the Plateau and returned by the direct trail to the B.C.M.C. Cabin where supper was served. All were unanimous in the opinion that this excursion had proved the most pleasant and profitable outing held this season, though some had forebodings of aching muscles for a day or two after the trip. The party was

composed of Mrs. Douglas McIntosh, Misses Kirk, M. Bain, N. Bain, Hyndman, I. Clemens, Aish, M. Armstrong, E. Sutherland, G. Rogers (Victoria), R. Stewart,

(Victoria), Thyne, and Messrs. J. Davidson, J. Lyall, F. Perry, McNair, Kirk, J. D. Turnbull, J. W. Turnbull, Wickson (Victoria), D. Nelson, R. R. Earle.

BIRD NOTES BY THE WAY IN THE MARITIME PROVINCES.

By HOYES LLOYD.

From March to October 1919 I spent about three months in the Maritime Provinces of Canada. There were three different trips as follows: March 16—May 7; July 15—August 10; and October; the last of which may be neglected here.

Those Canadians who do not know the Maritime Provinces have not seen one of the loveliest parts of their country. Although occupied with other things, every opportunity was taken to study the birds of this territory which was new to me. Dependence upon field glasses instead of specimens for identification of some birds seen was unsatisfactory, and should anyone care to question this species or that, I must advise him to go where the spruces fringe the roadside, where the muddy tidal flats shine in the summer sunshine, and see for himself.

Leaving Ottawa on March 14th, the only common birds to be seen from the train were Crows and a single straggling flock of Horned Larks. The Crows were already common in Quebec and New Brunswick along the Intercolonial Railway on the 15th. At Dalhousie Junction, an early Grackle was seen on the top of a pine. The icy expanse of Chaleur Bay with its patches of open blue sea gave little promise of Spring, but there was the Grackle in defiance of Winter.

On March 16th I walked across the frozen St. John River from Fredericton, New Brunswick, reaching the point where a small stream flows into the St. John. A flock of 18 Snow Buntings were found and many of them were singing in chorus. They had chosen a large elm for this rather unusual performance and all perched in the branches to enjoy or participate in it. This tree was evidently used solely for this vocal performance by the flock, for they flew off but returned shortly and resumed their singing.

The song was canary-like, interrupted

with twitters as in the Goldfinch and with the regular whirring flight note of the Snow Bunting. It was sweet and bubbling, being particularly attractive in a season when songs are scarce.

The historic Boardman Collection of birds is well cared for in the University of New Brunswick. Unfortunately the labels in this collection give only the names of the species and the number in Baird's check list. I examined the stands of a few of the mounted birds in a search for the usual data, but without success. Many of the mounted birds are crowded into large cases so that all but the outside birds are indistinguishable, and the cases do not open readily. For this reason it was impossible to study the collection carefully, as this could not be done without taking considerable time and putting the University authorities to a great deal of trouble.

On the 19th of March, after two days' rain which turned the snow-laden countryside into a veritable morass of snow, slush, and water, a short walk along the river road at Fredericton was taken in search of early migrants. Half a dozen Pine Siskins were found, and on the 29th others were noticed at McGivney Junction.

On that day I left Fredericton for Moncton. The ice had just left the Nashwaak River, although it still held in the swollen St. John. The American Goldeneyes had not been slow to take advantage of the open water and made pretty groups as they swam along the icy edges of the Nashwaak. Several large flocks of Grackles were travelling north up the river valley and I believe one Song Sparrow was seen.

East of McGivney Junction a Red-tailed Hawk (?) was coursing over the open barrens. At Moncton there was a dual attraction in the Petitecodiac River, the numerous Gulls and the bore, which stop-

ped the floating ice in its downward course and hurried it back upstream again. Most of the gulls were Herring Gulls, but an Iceland Gull spent April 1st and 2nd with them. This bird was smaller than the Herring Gull with distinctive white wing tips.

The first Robin arrived on the 2nd, but he must have been an optimist.

Then I resumed my journey, this time going to Halifax. There, at Dalhousie College, I was much delighted to see what I believe to be the only Canadian specimen of the Labrador Duck. It is well cared for, being kept in the vault, and is a beautiful specimen in an excellent state of preservation. This specimen, if Dalhousie would ever part with it, should be in the National Museum—perhaps the only Canadian specimen still in Canada of an extinct Canadian bird. However, I have recorded the result of my examination of this specimen elsewhere ⁽¹⁾ and regret that its alleged mate is an American Scoter.

On the night of April 6th a flock of Canada Geese passed over Halifax in a fog.

The land of Evangeline is too well-known to need any description of its beauties on my part. Toward evening on April 8th I saw the well, the monument and the willows in the little village of Grand Pré. Before the train passed two Black Ducks were seen to rise from the meadows and sweep out over the basin of Minas. For me, the romance and tragedy of the great poem seemed very vivid whenever I visited this locality.

As I journeyed to the south-west, Song Sparrows and Robins became common. The latter were flying up the Annapolis River in flocks. Many of the birds reaching south-western Nova Scotia must cross some 30 miles of open sea at the mouth of the Bay of Fundy. Study of the migration with respect to this crossing would seem to offer attractive possibilities.

At Digby, on the 9th, Juncos, Chickadees and a pair of Goldfinches were

noted. A pretty flock of eight Long-tailed Ducks was enjoying the spring sunshine on the waters of Annapolis Basin.

During a short stroll in the woods at Barrington Passage a single Ruffed Grouse was found. I had not enough time in the woods this trip to be able to say anything concerning their abundance; but they were reported as abundant in New Brunswick in October. Cape Sable Island, at the south-western extremity of Nova Scotia, was disappointing at this season.

Black-backed Gulls—half a dozen of them at least — on the waters of the Atlantic near Halifax, made an interesting sight, for I fear I had grown rather blasé toward common and more inland species.

At Halifax on the 14th of April Juncos and Siskins were noted in number, but the 24th brought a real little wave of migration to the shores of the north-west arm. The first Warbler of the year, a Myrtle, was encountered then, the Juncos were still present, but the real event was a flock of twelve Brown-capped Chickadees. For fear I would mistake their very different notes and habiliments a Black-cap was travelling with them to show how different he really was. If similar species of birds would do this regularly it would save much trouble for the student of birds.

On May 3rd at Amherst, Nova Scotia, a bright afternoon found me on the dyked meadows worrying—if one could really worry on a bright warm day of Spring—about Sparrows. Savannah and Song Sparrows greeted the sunshine with song, and Vespers were noted; Robins had become numerous.

Northumberland Strait between Pointe du Chêne, N.B., and Summerside, P.E.I., was clear of ice on May 5th, and abundant bird-life made the crossing of interest. Flocks of Scoters flushed ahead of the steamer continuously — the identified ones indicating the proportion of each species present. My estimate of these was 30 American, 30 Surf and 20 White-winged Scoters. One Red-throated Loon was noted in the dozen Loons seen, while 550 Herring Gulls and a single Great Black-backed Gull completed the Gull list.

Tree Swallows, Barn Swallows, Grackles, Robins and Juncos had already reached Prince Edward Island when I left on the

¹ Fleming saw one in Montreal some years ago which was not the specimen purchased by Dutcher, but its present condition, if still in existence, is unknown.

7th although snow-banks still persisted. The return crossing of the straits brought nothing new and I left the Maritime Provinces, returning at mid-summer.

Many birds which occur in the interior of New Brunswick shun the vicinity of St. John, or are rare. The Bluebird is probably an example of this. On July 20th birds seen on a trip to Seaside Park were: Herring gull 25; Nighthawk 6; Kingbird 2; Grackle 4; Song Sparrow 6; Purple Martin 2; Barn Swallow 6; Crow 12; Yellow Warbler 1; Maryland Yellowthroat 1; Robin 1.

A young Nighthawk brought to me in the flesh seemed very dark and was duly prepared into a birdskin. The trials of travelling were brought home to me when skin, wrapping, and all were dragged away to make a cosy nest for the mouse who lived behind the hotel wash-stand.

Bird life was abundant at Digby on the 22nd. Among the shore-birds were the ever-present Spotted Sandpiper and flocks of Leasts or Semipalmated, or both, moved up and down the broad mud flats in compact battalions. Novelties to me among the land birds were a flock of Purple Finches at midsummer, and a Blue-headed Vireo in full song.

July 24th was an eventful day. The morning was misty and hot — the kind of morning that fits the song of the Black-throated Green Warbler. The breeding ground of the Willet was our destiny, and once reaching it the birds fairly thrust themselves upon us. The air was filled with their cries and their beautiful poise

in alighting would charm any nature-lover. Almost 40 were seen.

Semipalmated Plovers had now appeared among the migrant shore-birds, and a single Piping Plover was noted in the crowd. A flock of Black Ducks rose from the salt marshes and young Acadian Sharp-tailed Sparrows were just able to fly.

A summer evening near Digby is made beautiful by the song of the Hermit Thrush in the Spruces, the last calls for the day of the Alder Flycatcher in the thicket and of the Olive-sided standing sentinel on a tree-top, while overhead the Nighthawk booms in the twilight.

In Charlottetown from August 2nd-6th, the southern migration of land birds appeared to be under way in spite of delightful summer weather. Some common birds noted were: Kingfishers, Downy Woodpeckers, Flickers, Nighthawks, Hummingbirds, Kingbirds, Olive-sided Flycatcher, Blue Jay, Crows, Goldfinch, Siskins, Red-eyed Vireos, Myrtle Warblers, Chickadees and Robins.

The Gulls and Terns frequenting the harbour puzzled me, I must admit. The Kittiwake I am fairly certain of, and Common Terns were doubtless present.

The Black-backed Gulls were now accompanied by young of the year, and a graceful group they made on the stone breakwater near Borden.

But ever-pressing work drove me from contemplation of the beautiful sea-scape and land-scape of our Eastern Provinces, which have distinctive charms all their own.

PROSECUTIONS.

MIGRATORY BIRDS CONVENTION ACT AND NORTH-WEST GAME ACT BY OFFICERS OF THE DOMINION PARKS BRANCH AND ROYAL CANADIAN MOUNTED POLICE.

Migratory Birds Convention Act. Nov. 1, 1920 and Feb. 1, 1921.

Placide Normand, Bonaventure Is., Percé, Gaspé Co., P.Q., possession of four young live Gulls. Birds seized and released. Suspended sentence.

Uldéric Drouin, Ste. Famille, Montmorency Co., P.Q., offering Herring Gull for sale; refusing information, forcibly resist-

ing arrest. Bird forfeited. Fine \$15.00 and costs.

Russel C. Clark, Mount Stewart, Queens Co., P.E.I., possession of two Canada Geese. Forfeited Canada Geese and one shot gun. Fine \$10.00 and costs of Magistrate's Court and Supreme Court of Prince Edward Island.

W. Boyle, 41 Marlboro St., Toronto, possession of one mounted Pileated Wood-

pecker. Specimen forfeited. Fine \$10.00 and costs.

Jno. Gray, 59 Marmaduke St., Toronto, possession of one mounted Pileated Woodpecker. Specimen forfeited. Fine \$10.00 and costs.

W. Raine, 50 Waverley Rd., Toronto, possession of eggs of migratory birds. Adjourned till called.

Geo. McNair, River Charlo, Restigouche Co., N.B., possession of one mounted Pileated Woodpecker. Specimen forfeited. Case dismissed.

Frank Woodworth, Campbellton, N.B., possession of one common Loon. Specimen forfeited. Fine \$10.00 and costs.

O'Neill Bros., St. John, N.B., selling Black Ducks. Fine \$100.00.

O. Trafford, St. Eugene, Ontario, possession of one Great Blue Heron, one Pileated Woodpecker, and one American Golden-eye. Specimens forfeited. Fine \$10.00 and costs.

G. F. Cunningham & Co., St. John, N. B., selling Black Ducks. Fine \$100.00.

Napoléon Pineau, North Rustico, Queens Co., P.E.I., attempting to kill a migratory game bird between the hours of sunset and sunrise. Fine \$10.00 and costs.

James Grant, Oulton's Post Office, Westmorland Co., N. B., killing a Great Blue Heron. Fine \$10.00 and costs.

In addition to above the following bird specimens have been forfeited:

Lang & Gilchrist, Owen Sound, Ontario, Great Blue Heron.

H. G. Morley, 162 Queen St., Toronto, Yellow Bellied Sapsucker.

W. Martin, Hanover, Ontario, Mourning Dove.

G. D. Brown, 26 Holgate St., Allandale, Ontario, Mourning Dove.

E. A. Laughter, Pakesley, Ontario, Pileated Woodpecker.

W. J. Mowers, Parry Sound, Ontario, (2), Rose-breasted Grosbreaks. Catbird, Scarlet Tanager.

G. F. Richman, Toronto, Ontario, Herring Gull.

Mr. Lepage, St. Eugene, Ontario, Hairy Woodpecker.

Dr. Munroe, St. Eugene, Ontario, Pileated Woodpecker.

W. Lacombe, St. Eugene, Ontario, Pileated Woodpecker.

O. Beecraft, Hamilton, Ontario, Pileated Woodpecker.

G. A. Doan, Hamilton, Ontario, Leon.

A. L. & S. M. Clarke, Darling's Is., N.B., American Merganser.

The Game Conservation Board of British Columbia has furnished the Dominion Parks Branch with a summary of 1920 prosecutions under the British Columbia Game Act, which amount to violations of the Migratory Birds Convention Act. This summary is given below:—

Description of Offence	Dismissals	Suspended Sentence	Convictions	Total Number of Cases	Fines & Penalties Imposed
Possession of Ducks during the close season	1	1	4	6	\$500.00
Possession of Ducks over bag limit . . .			2	2	85.00
Killing Ducks during close season . . .			8	8	125.00
Hunting Ducks from Power Boat . . .			6	6	285.00
Possession of Geese during close season . .	1		2	3	75.00
Possession of Wild Pigeons during close season			3	3	110.00
Killing Sea-Gull			1	1	10.00
Total	2	1	26	29	\$1,190.00

BRIEF REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB FOR THE YEAR 1920.

During the 42nd year of its existence the Ottawa Field-Naturalists' Club activities, which include lectures, field excursions and the publication of the Canadian Field-Naturalist, have been directed toward the popularizing and diffusing of knowledge of the natural sciences.

The club membership now numbers approximately 600.

A list of thirty-six lectures to be given by club members was sent to local societies, clubs, churches and schools from which they might select and request desirable talks, and as a result over 60 lectures on the following subjects were delivered: A Survey of a Prehistoric Indian Village, The Iroquois Indian, Folk Balladry of Quebec, Ranch Life, Bird Sanctuaries, A Trip Through the Peace and Mackenzie River Region, The Birds of Bonaventure Island, Birds of Eastern Canada, Bird Protection in Canada, Winter Birds and Mammals, The Migratory Birds' Convention Act, The Copper Eskimo, The Indians of Canada, Instances of the Influences of Physical Environment on the Indians, Amphibians and Reptiles, Canadian Birds, How and Where We get Dinosaurs, Canada's Natural Resources, Some Phases of Life and Scientific Work in the Canadian Arctic, Meteorites, Natural History of Lac Seul. The feature lecture of the year was delivered by Dr. Otto Klotz, Dominion Astronomer, at the Peoples' Forum under the auspices of the Ottawa Field-Naturalists' Club.

Five field excursions were held as follows:—May 1, Geology, Rockcliffe Park; May 15, General Natural History, Catfish Bay; May 29, Botany and Ornithology, Fairy Lake; June 12, Entomology, Aylmer; June 26, Horticulture, Central Experimental Farm. Scientific men attend the excursions to direct interest and answer questions.

The Canadian Field-Naturalist, the of-

ficial organ of the club, is now being used as a medium of publication by five affiliated societies as shown on the back cover.

The officers and committees for the year 1921 are as follows:

President, R. M. Anderson; Vice-Presidents, Hoyes Lloyd, G. A. Millar; Secretary, Clyde L. Patch; Treasurer, C. B. Hutchings; Editor, D. Jenness; Past-President, M. Y. Williams.

Additional members of Council: W. T. Macoun, Miss M. E. Cowan, P. A. Taverner, H. I. Smith, C. M. Sternberg, E. Sapir, E. M. Kindle, F. W. Waugh, W. J. Wintemberg, R. E. Delury, Arthur Gibson, Norman Criddle.

Standing Committees of Council.

Publications: Hoyes Lloyd, W. T. Macoun, Harlan I. Smith.

Excursions: F. W. Waugh, C. M. Sternberg, G. A. Millar, Miss M. E. Cowan, C. L. Patch, C. B. Hutchings, W. T. Macoun, H. Lloyd.

Lectures: Harlan I. Smith, P. A. Taverner, W. T. Macoun, G. A. Millar.

Trust Funds: W. T. Macoun.

Auditors: J. Ballantyne, E. C. Wight.

Leaders at Excursions.

Archaeology—Harlan I. Smith, F. W. Waugh, W. J. Wintemberg, C. M. Barbeau, Dr. E. Sapir.

Botany—G. A. Millar, W. T. Macoun, Mrs. A. F. Brown, Dr. M. O. Malte, E. C. Wight, Miss M. E. Cowan.

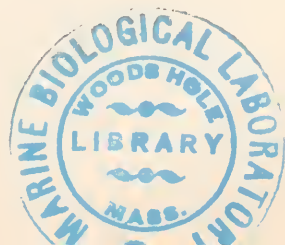
Entomology—C. B. Hutchings, Arthur Gibson, J. M. Swaine, F. W. L. Sladen.

Geology—Dr. E. M. Kindle, Dr. M. Y. Williams, H. McGillivray, E. Poitevin, Dr. M. E. Wilson.

Ornithology—P. A. Taverner, C. L. Patch, Dr. M. Y. Williams, A. G. Kingston, Hoyes Lloyd, R. E. Delury.

Zoology—Dr. R. M. Anderson, A. Halkett, C. L. Patch, E. A. LeSueur, C. H. Young, C. E. Johnson, E. J. Whittaker.

Photography—W. S. Hutton.



NOTES AND OBSERVATIONS.

MR. ARTHUR GIBSON — AN APPRECIATION.

With the last number of the CANADIAN FIELD-NATURALIST, Mr. Arthur Gibson, who has been the editor since 1910, ceased to fill that position, his increasing official duties having made it necessary for him to send in his resignation.

Seldom has an editor of a periodical which depends for its success on voluntary contributions, and has but slender means of support, served so long and faithfully and satisfactorily as has Mr. Gibson. His work must surely have been a labour of love or he could not have continued to edit the *Naturalist* for all these years. Only those in close touch with the work of the Ottawa Field Naturalists' Club and its organ know the tact and skill necessary to obtain matter for the *Naturalist*, and the popularity of Mr. Gibson among the contributors and the members of the Ottawa Field Naturalists' Club is a sufficient tribute to the manner in which he conducted the editorial work. Mr. Gibson by his many personal contributions also showed himself to be deeply interested in the success of the *Naturalist*, as often in a periodical of this kind the extra matter which the editor contributes from his own pen assures the publication of a satisfactory number.

Beginning with Volume XXXII, the *Ottawa Naturalist*, which had been published since 1887, was issued in the larger and more attractive form in which it appears to-day and the title changed to the *Canadian Field-Naturalist* to give it a wider field. This larger edition meant an increase in the editor's work, which Mr. Gibson cheerfully assumed.

We feel that all members of the Ottawa Field Naturalists' Club and subscribers to the *Canadian Field-Naturalist* must deeply regret the resignation of Mr. Gibson as editor, but at the same time appreciate his many years of unselfish devotion, and, in releasing him from his duties as editor, wish him much success as Dominion Entomologist.—W. T. M.

THE SPRUCE DRUMMER.—In spite of the fact that the Canada Grouse, or Spruce Partridge, has for many years enjoyed continuous protection, its numbers appear

to be slowly diminishing. In view of the characteristic stupidity of the species, this is not surprising. It is now seldom found except in the more remote woods and swamps. Here on a fine morning or evening in the autumn the moose hunter listening for antlered game may often be distracted by repeated flutterings as if a large flock of birds were feeding in some nearby grove. If he takes the trouble to investigate he is probably surprised to find that all the fuss is made by one bird, a spruce drummer (Spruce Partridge) who is ardently engaged in his exercise, or pastime, of drumming. He no doubt goes through this performance for the same reasons that the cock crows, or the cock robin sings. It is an assurance to his mate and a challenge to his rivals. The methods of this performance, however, seem further to justify the name of "fool hen" by which his species is sometimes known. His favorite location at such a time is between two trees standing apart some twenty or thirty feet, and with their lower branches large and horizontal. Perched on one of these branches he pitches downward, pausing midway to beat and flutter his wings, and ascends to a branch of the opposite tree. After a short interval this manoeuvre is repeated and so continued by the hour, swinging back and forth from tree to tree, the time between each swing being as exact as if measured by a watch. If such an ideal situation is not at hand the fact does not prevent the "fool hen" from giving vent to his exuberance. Selecting a small open space among the bushes, he takes his stand in the centre and like a jack in the box pops up a few feet in the air and giving his triumphant flutter drops again to earth. This method lacks the grace of the former, and when thus engaged the bird seems to justly merit the title of "Fool Hen". The sound produced by the drumming of the Canada Grouse can in no-wise compare with that of the ruffed grouse; it has neither the roll nor the volume. It is in fact little more than a flutter, such as might be made by birds forcing their way through thick branches after buds or berries. Unlike the Ruffed Grouse, however,

he seems to have no very strong objections to an audience. The performance of the birch drummer (Ruffed Grouse), can only be witnessed by the exercise of stealth and caution. Our little Spruce Partridge on the other hand will peer and look at the intruder and then, as if suddenly remembering, go through his evolutions with a gusto that excites our startled amusement. Though the drumming of the grouse is peculiar to the male its practice is not confined to the nesting season alone, but may be heard in any month of the year and occasionally at any hour of the day or night.

J. L. DEVANY.

SOME OBSERVATIONS ON BLANDING'S TURTLE.—During the summer of 1920 I spent several weeks at Point Pelée, Ontario, with a collecting party from the Royal Ontario Museum of Zoology. The first Blanding's Turtle (*Emys Blandin-gii*) was taken on June 15th, and from then until I left — July 23rd — it was much in evidence. The Point, having but a slight elevation above Lake Erie, permits many temporary rain pools apart from the main marsh, and it was in these pools, and along the sandy east beach, that most of the turtles were seen. At this season their terrestrial wanderings may mean a search for suitable sites to deposit their eggs, although it is known that this species is not strictly aquatic. However, I believe the majority of those seen on land were females — at least, those collected show this to be true.

At 6.30 p.m. on the 22nd of June I found two turtles preparing to deposit their eggs. Being determined to watch the process in spite of an empty stomach, and the hour for the attack of Point Pelée's mosquitoes drawing near, I kept one specimen under observation until excavation was fairly under way. Then, crawling within ten feet of the turtle, I watched the procedure without its showing any signs of fear.

Bracing itself up with its front feet, it dug with the hind feet, slowly carrying the sand to the surface on the upturned sole. In digging, the hind feet were always used alternately, the sand being placed first to the right and then to the left of the hole.

While using one hind foot in scooping from the bottom, the other was rested against the side of the hole, helping the turtle to raise itself in order to lift the sand to the surface. After the hole was two or three inches deep, the turtle settled back so that the edge of the carapace rested on the rim of the hole. In this position, and by extending the hind legs, quite a depth was attained. After three quarters of an hour this operation was completed. My presence, however, may have retarded the work.

I estimated the hole to be seven inches deep with a surface opening of three and one-half to four inches in diameter. This broadened out below the surface, making a flask-shaped chamber about seven inches in diameter. After one egg had been dropped, I returned to camp.

Later, I returned with another member of the party and found the location. There was not the slightest sign of depression or mound, and upon digging for the eggs we found the sand well packed. The eleven eggs were transferred to a box of sand in camp, where they were left exposed to the weather. We expected to hatch them and learn the time required for incubation, but an unfortunate accident happened to them on August 26th. Another member of the party was able to examine the broken eggs and preserve several fully formed young turtles. They would evidently have emerged in a short time, but the exact period of incubation was impossible to determine. However, it would have been something over sixty-five days.

BEHAVIOR OF CAPTIVES.

The party carried back a number of adult live specimens of Blanding's turtle which were easily kept alive in captivity. They fed upon earth-worms, dead fish and meat scraps, taking food readily, both under and out of the water. After a few days they showed no signs of fear, and were frequently handled without their closing the hinged plastron.

Without a suitable place to deposit their eggs, Blanding's will retain them for a considerable time. One specimen collected when digging the hole, retained the eggs for at least thirty days. I believe this to be injurious to the turtle if postponed too long. One specimen that died in mid-

winter had a number of fully formed eggs taken from it. Other individuals relieved this condition by depositing their eggs in the water in the tub which confined them. Unnatural surroundings are almost sure to produce unnatural behavior.

L. L. SNYDER,

Royal Ontario Museum of Zoology,
Toronto, Ont.

HORNBY'S PETREL.—Through the generosity of Dr. L. C. Sanford, of New Haven Conn., the Victoria Memorial Museum has lately come into the possession of a specimen of Hornby's Petrel, *Oceanodroma hornbyi*.

For many years it has only been known from the type specimen in the British Museum obtained by Admiral Hornby, previous to 1853, and has for long appeared on the Hypothetical List of the American Ornithologists Union on the basis of its vague locality, "N. W. America", as given in the Catalogue of *Birds of the British Museum*.

In the *Auk*, XXXIV, 1917, p. 466, H. C. Oberholser advocates its installation as a fully accredited American bird on the grounds that at the time of its capture Admiral Hornby had his headquarters on Vancouver Island and there is little doubt that it was obtained in adjacent waters. It is seen that the probability of its being a Canadian species is suggested by the same evidence. It should likely be placed on our hypothetical list until further substantiated by specimens.

There are few North American birds of which we know so little as we do of the Petrels and their allies. Many nest in the southern hemisphere on lonely rocky islets lost in the vast oceanic wastes. With such limited breeding areas the total number of some of them must be very small and subject to accidental vicissitudes. The introduction say of rats from a wrecked ship might and probably has before now wiped out entire species or left them on the verge of extinction. Pigs, goats and cats have had such effects on many such insular habitats. Few of these stations are ports of call, some are inaccessible except in the calmest weather, and their dangerous possibilities and lack of resources cause mariners to give them a wide berth; hence their biota has seldom been investigated.

Petrels are purely pelagic and spend their lives far at sea in vast irregular wanderings, making no regular migration except at such times as the duties of reproduction call them to these out-of-the-way shores. They flit across the pathway of shipping and are seen in passing by the deep-water sailor; but by the coaster or the long-shoreman they are seldom noted. The former has no time to stop, investigate or collect, and the latter no opportunity. Of many species it is only the accidental straggler that normally comes to the eye of science, and probably a greater proportion of species are known by individual specimens in this group than in any other class of birds.

So it remained with Hornby's Petrel until R. H. Beck, collecting for Dr. Sanford eighty miles off the Peruvian coast in 1913, happened to come upon a number and obtained a series of them, of which this specimen is one.

The generosity of this donation to our National collections indicates that Dr. Sanford regards ornithology as more than the amassing of specimens; he refused to take advantage of his opportunity to retain the material and make his collection unique in the possession of this rare species. Whilst this spirit is not rare enough amongst naturalists to excite remark it is none the less worthy of approbation, especially as there are instances where less breadth of view and generosity have been evident.

P. A. TAVERNER.

NOTES ON THE BEHAVIOUR OF THE CHIPMUNK—No. 2.—While in camp at Lake Misnag, Frontenac County, Ontario, during part of August and September 1920, I was able to add a few notes to my record of the behaviour of the Chipmunk (*Tamias striatus lysteri*). The Chipmunk with the very short tail, upon which I made the observations recorded last year (*Can. F.-Nat.*, Vol. XXXIII, p. 92), had disappeared from her haunts of last year, nor was she to be found anywhere in the vicinity. This was a decided disappointment, as I had hoped to find out something in regard to the duration of memory in this species. The burrow in which another individual had lived the previous fall was also deserted. However, seeing a Chipmunk about a large

Hemlock stump at the edge of the woods near my camp I placed kernels of corn and raisins on top of the stump, and was rewarded not only by *one* Chipmunk coming to carry off the food but *three*, and this gave me an opportunity to make a few observations on the social behaviour of this species. Two of these Chipmunks were very similar in size and coloration, the only difference being that the stripes on the side of the head of one were slightly more distinct than those of the other, but the third was easily distinguishable by its duller coloration, slightly larger size and the obscureness of the stripes on the side of the head. I shall call them Nos. 1, 2 and 3, in the order named above.

No. 1 and No. 2 were very friendly and on one occasion I saw them rub noses. No. 3 was not amiably disposed towards the others and if either of them were on the stump when it arrived it chased them away. Sometimes pursued and pursuer would go round and round the stump like a flash of light, exhibiting marvellous agility in racing about on its smooth sides. In their general manner Nos. 1 and 2 were much alike, and neither of them paid much attention to me, even when quite close at hand, once they had overcome their first shyness; but No. 3 was always "jumpy" and was not noticeably tamer at the end of the period of observation than at the beginning. No. 1 was the most confiding of the three, and on the third day allowed me to approach within a foot of it, while on the *ninth* day it took food from my hand.

Yellow-jackets (*Vespula diabolica*) were extremely abundant, and many came to feed on the raisins and boiled corn that I placed on the stump for the Chipmunks. One day No. 2 was stung on the front paw and shook it violently, then licked it.

I have seen it asserted that the Chipmunk is a poor climber, and that it rarely ascends trees. Though from past observations I knew this to be untrue, I determined to put the climbing ability of this species to a fairly severe test. Making a stake from a very smooth pole of Paper Birch five inches in diameter, I drove the stake into the top of the stump, then fastened kernels of corn at intervals up the stake and placed some corn on the top of the stake. No. 1 came along, climbed the stake,

taking the kernels on its side as it went up, and sitting up on the top filled its pouches with the corn it found there. Next time it came it hunted over the top of the stump, and finding no corn there, climbed the stake and took the supply I had placed there. Thus this little experiment not only showed the climbing ability of this species, and enabled me to take a photograph of it in the act of climbing, but also gave another example, in addition to that reported last year, of the rapidity with which the Chipmunk forms associations.

Do Chipmunks habitually climb to secure any of their items of food? In the case of Hazel-nuts (*Corylus rostrata*) they certainly do, as the Chipmunks I had under observation climbed these shrubs, cut off the nuts and carried them away. Moreover they do not appear to waste any time cutting off bad nuts, as all the nuts left on these bushes after the Chipmunks had visited them proved on examination to be bad. How they distinguish good from bad nuts, and how they deal with these nuts in removing the hulls which are beset so thickly with irritating bristles which stick tenaciously in the human skin, are among the few thousand things we do *not* know about our common wild mammals.

A. BROOKER KLUGH.

ARCHAEOLOGICAL EVIDENCE CONCERNING THE PRESENCE OF THE GRAY FOX (*Urocyon* sp.) IN ONTARIO.—Among the animal remains found during my exploration last summer of the Uren village site in South Norwich township, Oxford county, Ontario, are several lower jaws and part of a skull which Dr. Gerritt S. Miller, curator of the Division of Mammals, U. S. National Museum, has identified as those of the Gray Fox (*Urocyon*). While bones of this animal have been found by archaeologists in Ohio,¹ Pennsylvania,² and Connecticut,³ this discovery in Oxford county is probably the only record of its presence in Ontario, beyond the vague statement by Audubon and Bachman that "in Canada we have heard of its occasional, but rare appearance."⁴

The Gray Fox seems to have been as common as the Red Fox, of which we also found several bones, but it probably never

was as abundant in this part of Ontario as in southern Ohio, where the Baum village site, explored by W. C. Mills, alone yielded "over two hundred lower jaws and twenty fragmentary skulls."

W. J. WINTERBERG.

¹ See Mills, William C., *Explorations of the Gartner Mound and Village Site*, Reprint from the Ohio Archaeological and Historical Quarterly (Columbus, 1904), Vol. XIII, p. 32; *Explorations of the Baum village Site*, Reprint, idem, 1906), Vol. XV, p. 29; and *Archaeological Remains of Jackson County*, Certain

Mounds and Village Sites in Ohio (Columbus, 1912), Vol. 2, Part 2, p. 80. See also Langdon, Frank W., *The Mammalia of the Vicinity of Cincinnati* Journal Cincinnati Natural Society (1880), Vol. II, p. 297

² See Mercer Henry C, *An Exploration of Durham Cave in 1893*, Reprint from Publications of the University of Pennsylvania. (Boston, 1897), pp. 156, 159, 161, 171 and 173 (footnote).

³ See MacCurdy, G. G., *The Passing of a Connecticut Rockshelter*, The Am. Journ. of Science (1914), Vol. XXXVIII, p. 517.

⁴ Audubon, J. J., and Bachman, Rev. J., *Quadrupeds of North America*, (New York, 1849), Vol. I, p. 172.

EDITORIAL NOTE.

Owing to a variety of causes it has been impossible to start the new volume of the Canadian Field-Naturalist at the beginning of the calendar year. The last number of Volume XXXIV was nearly five months overdue on account of the difficulty the publishers experienced with their paper supply. Our new publishers promise us steady production, so, if our numerous contributors will co-operate by furnishing clean type-written material, the editor hopes to overtake his arrears and finish up the present volume at the proper time.

Subscribers to the magazine will welcome a brief statement of the financial difficulties with which the club has to con-

tend. The total number of subscribers on the books at the end of 1920 was 560. The annual subscription, formerly \$1, was raised to \$1.50 to meet the increased cost of publication; but there were 403 subscriptions overdue, representing an amount of \$564. The actual cost of publication is slightly greater than the amount obtained from subscriptions if every member pays his dues, the balance being made up from advertisements and the sale of extra copies. The finances of the club are therefore very restricted, and every member is urgently requested to assist the treasurer by sending in his subscription as soon as it falls due.—D. J.





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THE LARGER FRESHWATER — CRUSTACEA FROM CANADA AND ALASKA.

By FRITS JOHANSEN.

(Continued from Vol. XXXIV, p. 148.)

III. EUPHYLLOPODA (BRANCHIOPODA).¹

The crustacea belonging to this order comprise the three super-families of the "fairy shrimps" (Anostraca or Branchipodidae) the "tadpole-shrimps" (Notostraca or Apodidae), and the "clam-shrimps" (Conchostraca or Limnadiidae (Estheriidae)). Most of the species are of a fair size and easily observed at the right time of the year by any one interested in freshwater life.

They derive their name from the fact that most of the appendages ("feet") behind the mouth parts are peculiarly formed so as to serve as respiratory or locomotory organs, being divided up into many hairy leaves or flagella. When present the tail has no appendages, with the exception of its last joint, and the body is composed of a great number of segments.

From olden time, these interesting crustacea have attracted both laymen and scientists, not only because of their peculiar biology (seasonal occurrence, etc.), but also because they have been considered as representing a very ancient type of crustacea, if not the origin of that numerous and widely distributed class. At any rate, fossil remains of these crustacea or similar forms have been found in deposits of great age; viz. Conchostraca from the Devonian, Notostraca from the Trias, and the Anostraca from the Oligocene (Tertiary) on.

The first important works on these crustacea were published by the Danish Zoologist O. F. Muller in the latter part of the 18th century; since then a great number of workers in different countries have studied them very carefully, of whom G. O. Sars

in Norway, W. Baird in England, C. C. Claus in Germany, E. Daday de Décs in France, and A. S. Packard in the United States, have probably contributed most (see bibliography).

A. FAIRY-SHRIMPS.

The first sub-order (super-family) Anostraca is easily distinguished from the two others by the lack of a shell (carapace) and by the elongated shape of the body, in which the head is distinctly marked off.

The general form of these "fairy-shrimps" has been often described and may be assumed to be fairly well known,¹ so that only the essential points need be referred to here. The head carries two pairs of feelers (antennæ) of which the first pair is short and slender, but the second pair much longer and stouter and is in the males extraordinarily developed as clasping organs (for use during copulation), and of greatly varied form often with accessory appendages, etc. On the front end of the head is situated a simple unpaired, median eye, remnant of the large nauplius-eye of the larval stage. More conspicuous, however, are the two large, composite eyes on short peduncles which are very movable and have brilliant, metallic colours. The mouth (on the under side) is supplied with various masticatory parts (maxillæ, mandibles, etc.), and behind them follows a greater (11 or 17-19) number of ambulatory trunk-limbs, the foliaceous, hairy legs, of which the first and last pairs are the shortest. They are admir-

¹ See Ottawa Naturalist, July, 1895 (A. Hallett) and April, 1890 (E. E. Prince).

ably suited for propelling the animal, moving consecutively, as grain stalks before the wind, but they have also respiratory importance, being subdivided into inner and outer parts, and even those far from the mouth have "gnathobases" (chewing parts), and pass along by their movements any food that is secured. The last pair is modified for reproductive purposes. The conspicuous genital organs mark the boundary between the prae- and the post-genital regions, both mostly of about the same length. With the ripe males the copulatory organ presents a mostly bifid, smaller bag; while with the females it is an oblong or more rounded (elliptical) sack containing, at the right time of the year, the eggs. The tail is mostly long and slender and consists of 8-9 joints; it ends in two furcal rami (cercopods), only exceptionally united (*Thamnocephalus*).

Except when strongly colored the animals are so transparent that the internal parts are to be seen plainly with a magnifying glass; most conspicuous is the long slender "heart" extending through nearly all the trunk-segments (somites) dorsally and with a pair of openings (ostia) on each of these. The alimentary canal is also conspicuous, owing to the food filling it out; it is seen stretching as an almost uniform tube to the end of the last tail segment, where it opens. The maxillary gland (excretion organ) is also conspicuous on the underside of the head (it is especially large in the younger stages); and in the males the white testes and their auxiliary organs (vasa deferentia) are plainly seen in living individuals, though not so conspicuous as the female's unripe (ovarial) or ripe eggs. Less conspicuous are the ladder-like nervous system (though the brain is large and well defined) and the little differentiated blood vessels.

The fairy-shrimps have this in common with most of the crustacea, that their young stages are quite unlike the full-grown animals. The egg hatches into a larva, the so-called nauplius or metanauplius. It is often only the size of a pin-head, but usually of a vivid, red color, and of an oval or pear-shape. The first pair of antennae is longer than in the full-grown individuals and pointed directly ahead; they are probably used as balancing

more than as locomotory organs. Between them is the large median eye. There follows the second pair of antennae greatly developed as the principal swimming organs and divided up into several long, spined branches. Of the mouth parts the mandibular-palps are the most developed and leg-like; they also help in swimming, having long hairs. The somites carrying the foliaceous legs are little differentiated, and the more posterior ones as yet only represented by hairy serrations on the under side of the "abdomen". No tail is yet present, the hind-end of the larva being rounded-tapering. These nauplii make up for their inconspicuous size by their violent movements; they probably subsist right after hatching for a time on the yolk they contain.

The nauplius grows rapidly both in length and in the development of the appendages and soon reaches the metanauplius stage, which is so-termed owing to the presence of larval and adult characters. Thus the second pair of antennae and the mandibular palps are still large and the principal swimming organs, and of the foliaceous legs and abdominal segments only the foremost are developed to any extent and well marked off from the succeeding ones. The tail is short and clumsy and little differentiated from the abdomen, merely tapering from the latter. On the other hand there are now besides the median nauplius eye two large composite eyes, though their peduncles are less pronounced than in the fullgrown individuals; and the maxillary gland seems to reach its highest development (size) in the metanauplius stage. The more oblong shape of the whole body, the beginning differentiation and development of somites and foliaceous legs and tail, and the proportions of the various appendages compared with the length of the whole animal, also make this stage very distinct from that of the nauplius.

Gradually the metanauplii grow in length and take on the appearance of the adults. The foliaceous legs all become fully developed and assume their locomotory duties, and simultaneously the second pair of antennae becomes more rudimentary (females) or transformed into the claspers (plus accessories) of the males.

The mouth-parts lose their former locomotory functions and become limited to masticatory processes. The genital organs begin to appear and the tail grows rapidly in length, so that soon the shape of the adult is reached, and only the particular development of the claspers and the genital organs remain. The eggs of the fairy shrimps apparently do not all hatch at the same time (day). I have observed how nauplii and metanauplii or young and full-grown individuals are present together in the same pond, though the great majority of the individuals are either in one stage or the other.

The fairy-shrimps are of a transparent reddish, yellowish, blueish or greenish color, more pronounced on some parts of the animal than on others. Besides, certain species, especially the females, have additional strong purple, violet, brownish or black colors in patterns characteristic for each species, though there is great variety in the intensity in the various individuals. In the males the most strongly colored parts of the body are generally the claspers (second pair of antennæ) and in the females the parts near the ovarium; also the underside of the head, the foliaceous legs and the tip of the tail in both sexes. The ripe eggs have a strongly yellow, orange or light brown color.

The fairy-shrimps swim in the water with equal facility upon the belly or upon the back, according to whether their food is above or below them in the water. Locomotion is accomplished by means of the foliaceous legs and by the long tail serving as a rudder; when disturbed they will make a sudden jerk with the tail and dart in one or the other direction. Where there is a strong current in the pond (lake) in which they live they will go with it though moving their foliaceous legs all the time; in quieter pools the younger individuals especially (metanauplii and slightly older ones) will float in the water belly downwards with little apparent movement from place to place, if left undisturbed. Their food consists of smaller, aquatic invertebrates (Cladocera, etc.), and I have often observed them "browsing" in the mud-bottom of the pond or among the green algae there. In return they form an important item in the diet of certain aquatic

insect larvæ (beetles, caddis-flies, etc.) or young fishes, against which they have little other protection than their transparency. Just prior to and during the time the eggs are becoming ripe the females generally carry the males around; the latter seize their mates around the genital somites dorsally with their claspers and retain their hold until the time of copulation is over. Then the males leave their "victim" for another female and repeat the process, which is perhaps a necessary procedure as there are generally far more females than males of a certain species in the same pond. When the eggs have been laid they, so far as has been observed, rise to the surface of the water and float there until hatched, or if the pond dries up or freezes to the bottom they remain (hibernate) in the mud until hatching is possible, when the pond is again filled with water or its ice melts. As a matter of fact this desiccation or freezing (hibernation) of the eggs seems to be necessary for their development (see *Ottawa Naturalist*, April, 1896, Prince).

The sudden appearance of the fairy-shrimps is truly wonderful and has long puzzled students. Outside of the arctic they are generally found only in temporary pools or ponds, being hatched there in thousands as soon as the ice in the latter melts or when they are again filled with water. In the arctic and probably in mountain-lakes (ponds) at high elevation, say about 10,000 feet, where the conditions are similar, nauplii appear (hatch) immediately after the ponds melt (June), and the animals have thus a period of 3-4 months in which to grow to maturity and deposit their eggs in case the pond they are found in does not dry up before the water freezes and all, except the hibernating eggs, are killed off by being frozen into the ice, or die a natural death. At more southern latitudes, however, and at lower elevations, the ponds in which they occur are far more likely to dry up; thus near Ottawa, Ontario, I have found the first ones in the middle of April², when they (*Eubbranchipus gelidus*) were about 1 cm. long, thus young individuals probably hatched a couple of weeks before; the full-

² See also Halkett's observation. *Ottawa Naturalist*, July, 1895, p. 89.

grown ripe individuals collected by A. G. Huntsman near Toronto, Ontario, in June 1908, probably represent their last appearance in the summer. Young ones (3-10 mm.) were collected on April 10, 1920, near Toronto, Ontario; they therefore probably hatch earlier near Toronto than at Ottawa. Near Ottawa I have not observed them later than the month of May, and in all cases they were found only in temporary pools or canals caused by snow melting and the overflow of the Ottawa, Gatineau or Rideau Rivers in the spring. As to their occurrence in the United States I refer the reader to Packard's and Verrill's articles about them; it is sufficient here to state, that while certain species occur only in the winter and early spring, others are present both in the spring and in the fall, but not in the summer; while again others (*Artemia*) are found when the water is very warm.

According to my own field observations during a period of three years along the arctic coast of north-western America I may safely state that there is only one "brood" (generation) per year in the arctic; the same is probably true of the sub-arctic zone of this continent; while in southern Canada and the United States two or more broods (generations) per year may occur; though the long time during which the ponds are dried up during the summer here probably restricts the number of generations considerably.

Apart from the enemies in (insects, fishes) and outside (birds) the water a great number of fairy-shrimps (and Notostraca as well) are killed off prematurely in the summer or autumn by the drying up of (at least in the arctic) the particular small pond in which they live or by being thrown up along the margin of the particular lake by waves in windy weather, as I have repeatedly observed in the arctic parts of America and Greenland. I have also observed how a great number of phyllopods in the fall freeze into the ice as the latter begins to form and grows in thickness, though a number of individuals were living in the water right under the ice, even if there were only a few inches of free water. It will, therefore, be realized how important it is for the propagation of these animals, that they occur in such vast num-

bers and that the hatching of the eggs takes place almost immediately after the melting of the pond or lake-ice in the spring, or after the autumn rains (absent in the arctic) have filled the dried up reservoirs in which the eggs are lying.

The fairy shrimps on this continent are divided into two groups (super-families) according to the number of their pre-genital, foliaceous body-legs. The one group (*Polyartemiidae*) has 17 to 19 pairs of these while the other group (comprising the great majority of fairy-shrimps species) has only 11 pairs.

To the first group belong two genera, of which one (*Polyartemia*, 19 pairs of foliaceous legs) is not found in America, but a species (*P. forcipata* Fisch.), occurs in the arctic parts of Europe and Asia, both in Scandinavia and Siberia and probably also in the intervening arctic part of Russia³. Its biology, structure and development have been given in detail by G. O. Sars, in *Fauna Norvegiae*, 1896, pp. 59-65.

The genus found in America is *Polyartemiella*, so-called owing to its similarity to *Polyartemia*, from which it, however, is distinguished by having two pairs less of foliaceous legs. Curiously enough the genus *Polyartemiella* seems to be limited to the arctic and subarctic parts of Alaska and Yukon Territory, and thus resembles somewhat the freshwater Amphipod *Synurella*. In the same way as *S. johanseni* has its nearest relatives in Europe and Asia, so have also the two known species of *Polyartemiella* their nearest relative in the Eurasian form *Polyartemia* mentioned above. Considering their respective distribution we may perhaps assume, that both *Synurella* and *Polyartemia* have their original home in Eurasia, and have spread from there to the northwest corner of America, where then the latter genus became transformed in the course of time to the only slightly different genus *Polyartemiella*. This invasion of America took place perhaps via a former land-connection between Siberia and Alaska, a view which is supported by the fact, that one of the *Polyartemiella* species (*P. judayi*) has been found upon at least some of the islands in the Bering Sea (De Déés).

³ Recorded from Novaja Semlja (Hansen).

The males of the two *Polyartemiella* species are easily distinguished by their claspers. In one (*P. hazeni* Murdoch) the claspers are big, antler-like processes with four branches: in the other (*P. judayi*, De Déès), they are more like fish-hooks (or sickles) and three branched, thus more like those of *Polyartemia*.

The first named species, about 1 cm. long, was originally discovered by Murdoch of the International Polar Expedition in tundra pools at Point Barrow, Alaska, in the middle of July, 1882, and described and figured by him in the reports of the said expedition p. 150. A better description and figure of it has later been given by De Déès, p. 106-07, (1910); according to Pearse⁴ it also occurs at other places along the arctic coasts of Alaska and Yukon Territory. It has hitherto not been found east of the Mackenzie River. During the Canadian Arctic Expedition I secured in tundra ponds at Teller (Port Clarence), Alaska, a couple of males and half a dozen females of apparently the same species in the beginning of August, 1913. They differ in various points from Murdoch's description, but a full account and figures of them will be given in the reports of the Canadian Arctic Expedition (Vol. VII, Part G.) to which I refer.

Polyartemiella judayi (about 12 mm.) was originally described by De Déès in *Annales des Sciences Naturelles*, Paris, 9th series, Vol. XI, 1910, p. 108-11, from specimens collected by Dr. Juday on the Pribilof Islands in Bering Sea. I did not myself find this species in Alaska, and as is the case with the other species (*P. hazeni*) little is known about the life history, the young stages not having been secured as yet, though both sexes are known.⁵

The genus *Polyartemiella* thus seems to be limited to the arctic and subarctic parts of northwest America, west of Mackenzie River.

To the second group of fairy-shrimps (those with 11 pairs of foliaceous legs)

⁴ *Polyartemiella hansenii* (Murdoch) coll. by J. M. Jessup at Muskeg Lake, lat. 69° 40' N., long. 141° W., July 25, 1912, and at Muskeg pools on flood plain of Firth River, lat. 69° 20' N., long. 141° W., June 23, 1912 (Pearse, 1913).

⁵ The females are a few millimeters longer than the males.

belong three or four families, of which only two have been recorded from Canada and one of these latter also from Alaska. The characters separating the families are not very good, because they are mainly the appendages (claspers and accessories) on the head of the ripe males, and even two species belonging to the same genus are extremely different in this respect. I, therefore, do not find it necessary to give the distinctions between the families here, beyond mentioning, that the genus *Thamnocephalus*, which occurs in the middle parts of the United States (Kansas, Colorado, etc.), is very distinct from all the other fairy-shrimps belonging to this group, by reason of the fusion of the post-genital segments and the cereopods.

Probably the most widely distributed of all fairy-shrimps is the circumpolar form *Branchinecta paludosa* O. F. Müller. It reaches a length of 2 cm., and the male claspers are fairly simple (though when the animals are ripe, well developed), consisting of a stout and long, cylindrical basal part with a row of short spines on their inner margin, and when fully developed, a little longer, more slender, triangular and falciform, apical part (joint). The protruding parts of the male genitalia are thick, arcuated and paired (bifid), while the ovisac of the female is very long, slender and thickest near its free rounded end.

This species was first described by Otto Fabricius from West Greenland as *Cancer stagnalis* (Fauna Groenlandica, p. 247, 1780), and much confusion was caused by his thinking it was the same as Linnaeus' species of the same name from Europe, and by O. F. Müller in his *Zoologia Danica* II, calling it *Cancer paludosus*, in the belief that it was the same genus as the species (*Branchipus stagnalis*), occurring upon the continent of Europe and first recorded by Linnaeus as *Cancer stagnalis*. It was finally established as being the circumpolar, arctic form *Branchinecta paludosa* by Verrill. It is distributed from Alaska to Greenland in the new world, and in Eurasia it has been recorded from northern Scandinavia, Spitsbergen, Novaja Semlja and Siberia. Curiously enough it has not yet been found in East Greenland. Another species (*B. gainii*) of the same genus was found by Chareot in the Antarctic.

As to the southern boundary of the distribution of *B. paludosa* on this continent little is known; but the records of it from Commander Islands, Siberia (Lilljeborg, and the Pribilofs (U.S.N.M.) indicate that it is found at least upon some (western?) of the Aleutian Islands. Also, some young ones were collected by J. M. Jessup in a puddle at Whitehorse, Yukon Territory, June 7, 1912 (Pearse, 1918). I did not observe it at Nome or Teller, Alaska, but it was found by Murdoch at Point Barrow in the same pools as *Polyartemiella hazeni*. I found it very common along the coast from Camden Bay to Demarcation Point, Alaska, and also on Herschel Island, Yukon Territory, in the summer (June-August) of 1914. It was also collected by J. M. Jessup in Muskeg Lake (lat. $69^{\circ}40'N$. long. $141^{\circ}W$) on July 25, 1912 (Pearse, 1913). We may, therefore, perhaps assume that it occurs over the whole of Alaska and the Yukon Territory, except the southern part of the former, at a certain time of the year, and where suitable ponds or lakes are present. Dr. J. Rae brought back from Cape Krusenstern, Dolphin and Union Strait, Northwest Territory, some fragments of both sexes collected in August, 1849; they were referred by W. Baird to this species. According to the great number of observations and collections of this species by me in 1914-16 in this locality (Bernard Harbour) there can hardly be any doubt about it, an opinion also expressed by Verrill and Packard. It was further secured (Sars) by the "Gjoea" Expedition (Amundsen) on the south side of King William Land, in 1904 and 1905; by the "Neptune" Expedition at Fullerton on the west side of Hudson Bay in 1903-04; by Turner in pools on rocks at Fort Chimo, Ungava; by Packard in August, 1864, and by Bryant in 1908, at Hamilton Inlet in Labrador; by the Second Norwegian Arctic Expedition on Johan Peninsula, Ellesmere Land, in 1898-99; by Hart at Discovery Bay (lat. $81^{\circ}41'N$.) and by the Princeton Expedition, 1899, at Cape Sabine, on the west side of Grinnell Land. In west Greenland it has furthermore been recorded from a number of places up to Polaris Bay (about lat. $82^{\circ}N$.), where it was taken by Bessels in August 1872, (Packard), and on Northumberland Island, (Ortman). There can therefore be little doubt that it occurs

upon all the islands composing the Canadian Arctic Archipelago.

The structure and biology of this species has been so well treated and figured by G. O. Sars in his monumental work (1896) that I need only refer briefly to the life-history. The additional observations I was fortunate to make during my stay along the arctic coast of northwest America with the southern party of the Canadian Arctic Expedition 1913-16, will be found in the reports of the said expedition (Volume VII, Part G). Suffice it to say that its whole life-history is now known, because I secured in the north still earlier stages than Sars' metanauplii (see his Tab. VIII) and actually succeeded in rearing in the spring the nauplii from hibernating eggs kept all through the winter. Its life-history is, therefore, the following, at least in the arctic part of northwest America. The hibernating eggs frozen in the ice, hatch out a little after the latter melts in the spring or early summer (June), and the nauplii and metanauplii continue to grow until at the end of July or beginning of August they are sexually ripe. The copulation and laying of the eggs then takes place during August and part of September, until the water freezes and kills them all except the eggs. Apparently, however, a great number of the adults die a natural death from the middle of August on, presumably when copulation and egg-laying is over. That they are also killed off by other causes (enemies, waves, drying up of the ponds) has already been referred to. The earliest records in the year I have from this coast is Chantry Island, June 17, 1916, (a couple of nauplii and many metanauplii), and the latest record is adults of both sexes from Bernard Harbour, August 23, 1915 (specimens kept).

Mr. A. Halkett writes in his field-notes from the "Neptune" Expedition, that female phyllopods of this species (identified by Prof. G. O. Sars of Christiania, and by me) were collected in ponds at Fullerton on the west side of Hudson Bay as late as the end of October and the beginning of November, 1903. The water-depth of one of the ponds was about seven feet, and they were then all covered by ice, which in the last days of October was of a thickness of about one foot. The temperature of the air was about zero, and that

of the water around freezing-point. The water on testing showed to be slightly saline, though used for drinking-purposes.

Since my return from the expedition I received from Professor A. Willey, of McGill University, Montreal, P.Q., six adult branchipods (4 females, 2 males) which so far as I can see belong to this species. They were collected in a pond cut off from the river at Point St. Charles, near Montreal in May-June about 20 years ago. Professor Willey informs me that they have not been observed in that locality since. They were about 2 cm. long, and the females had ripe eggs in the brood-pouch. This is certainly a most extraordinary record, and quite at variance with what one should expect—to find this circumpolar form at Montreal. The species has been recorded from the Carpathians (De Décs), so it would be far more natural to expect to find it in the Rocky Mountains than in the lowlands of the St. Lawrence River. However, the shape of the male claspers, their rows of spines, the oblong ovisac of the females, etc., makes me feel confident the specimens belong to *B. paludosa*. The eggs were perhaps brought with a ship returning from Labrador or other part of the eastern arctic and then developed when the snow melted in the spring. My identification of these specimens from Montreal has been verified by Professor A. S. Pearse, of Wisconsin University (letter to me of March 29, 1920).

In Europe this species has been recorded from high altitudes in the Carpathians, but the above record from Montreal, Que., is the only instance known of its occurrence on this continent outside the arctic or sub-arctic regions.

A couple of other *Branchinecta* species are found in the middle United States, but have so far not been recorded from Canada or Alaska, and are not likely to occur here, though one of them (*B. coloradensis*) is perhaps an arctic relict form, being found only in ponds and pools on the highest mountains (above 10,000 feet) in Colorado.⁶

Nor has the interesting fairy-shrimp *Artemia salina* (*A. fertilis*, *A. gracilis*, *A. monica*), known from many parts of Europe,

West Greenland and some of the States, (Connecticut, Utah, California), and in lower California, been found in Canada so far.⁷ Much has been written about this species as to its sudden occurrence in salt lakes, and in railway tubs filled with brine, where it can withstand more than 270 grains of salt per litre, and where its red color increases in intensity with that of the salinity of the water. This is also the species to which the common European form *Branchipus stagnalis* (*B. ferax*) transformed by degrees when the salinity of the water in which it occurred was increased, as also the reverse occurred when the water was diluted, according to Schmankevitch's investigations. On this continent, however, *Branchipus stagnalis* does not occur (the species mentioned in *Ottawa Naturalist*, July, 1895, and April, 1896, is almost certainly *Eubranchipus gelidus* Hay), and so far as I know the experiments referred to above have not been successful over here, though there are apparently no generally accepted characters separating the genus *Artemia* from that of *Branchinecta* or *Branchipus*.

Of the genus *Eubranchipus* half a dozen species are known on this continent, the majority of them only from the United States, though all from the northern and middle States, and none from the west. Only one species (*E. gelidus* Hay) has so far been found in Canada and Alaska, but at least some of the others may well be found to occur in the Dominion, as they are known from New England to Wisconsin south of the boundary line, and one species (*E. vernalis* Verr.) has a very wide distribution. Perhaps the most widely distributed species is *E. gelidus*, which has so far been recorded from Massachusetts, New York and Indiana in the States and from Ontario and Yukon Territory in Canada; it also occurs in Alaska. For records in Yukon Territory and Alaska see Pearse, 1913. It is extremely common around Ottawa in the spring, and occurs on the Quebec as well as on the Ontario side of the Ottawa River. There can be little doubt but that this is the species A. Halkett observed in 1893 and 1894 at New Edinburgh, Ontario, (*Ottawa Naturalist*, July,

⁶ The eggs of this species are unusually large.

⁷ It may occur in Southern Ontario or Quebec, judging from its presence in Connecticut.

1895). Apparently he did not preserve the specimens, but it is the only fairy-shrimp I have found occurring around here. The female especially is easily distinguished from the other species belonging to this genus, having the ninth and tenth body segments produced into lateral, triangular processes dorsally, probably serving for copulatory purposes. The ovisac is broad and elliptical and contains about a dozen ripe, yellow-brown eggs. When the animal is swimming it is continually moving from side to side, so the eggs roll around inside. The clasping antennae of the male are somewhat claw-shaped with a short swollen basal part supplied with two medio-ventral, short spines, and a more slender and longer terminal part with bifid tip. Twice as long, however, are a pair of accessory organs at the base of these antennae (claspers) dorsally, in the shape of broad, lobated appendages which we may suppose are used for "tickling", or twisted around the female's body during copulation. The protruding male genitalia is a bifid sack ending in two pointed appendages.

These fairy shrimps attain a size of $1\frac{3}{4}$ cm. in May-June, when they are ripe, and vary greatly in color, the females especially having much rose-orange, blue and black-brown pigmentation; but my observations regarding the colors of the many individuals I have examined are too detailed to be included here. The paired eyes are dark purple and the tips of the cercopods white; the latter color shows up very conspicuously when the animals swim in the water. Of this species I have examined specimens from the following Canadian localities.

Montreal West, P. Que., May 5, 1920, A. Willey, coll., adult male and female, the latter with eggs.

De Grassi Point, Lake Simcoe, Ont., May 10, 1915 and May 6, 1917, E. M. Walker, coll., 27 adults, 12 males, 15 females, $1-1\frac{3}{4}$ cm. long.

Scarborough Junction (Toronto), Ont., June, 1908, A. G. Huntsman, coll., 11 adults (5 males, 6 females), $1\frac{1}{2}$, $1\frac{3}{4}$ cm. long (see *Natural History of Toronto Region* 1913, p. 275).

Ponds near Bond Lake, Toronto, Ont., (York County), April 10, 1920, A. G.

Huntsman, coll., (young stages, 3-10 mm. long, immature).

Around Ottawa I have collected them in temporary pools or canals at various places, at Hull Park, near Fairy Lake, Deschenes and Tenaga (Gatineau River), on the Quebec side, and at various points (Billings Bridge and Hartwell Locks) along the Rideau River on the Ontario side. Around Ottawa the nauplii hatch soon after the melting of the snow and the breaking up of the rivers, and the pools they occur in are literally teeming with them. They are found in pools on open fields or pastures as well as in the woods; already at the end of April they are $\frac{1}{2}$ cm. long and the females carry their light brown eggs in the sack. The smallest number I have seen in one pool is $\frac{1}{2}$ dozen, which were collected on April 20, 1919. I tried to keep a dozen of them, (4 males, 9 females) alive in a jar. The next day, however, two of the females and three of the males died; before the first of May the last male and a couple of the females died, during the beginning of May the rest of the females died except one which lived until May 7th. It will thus be seen, that these animals are more hardy than is generally supposed, especially the females; no food was given them while they were kept in confinement. I observed, that one second elapsed between two succeeding turnings-over of the egg-sack from right to left, or the reverse, when the female is swimming; the movement is apparently for the purpose of bathing the enclosed eggs in the water passing in and out of the egg-sack. May or June is probably the last month in which they are present in southern Ontario and Quebec; from July on all the pools in which I have observed them earlier in the summer are dried up and the deposited eggs remain in the bottom, probably hatching the following spring.

Prof. O'Donoghue, of the University of Manitoba, tells me in a letter (June, 1920) that "a species of *Branchipus*, or more probably an *Eubbranchipus*^s) is fairly common all around Winnipeg, on both sides of the Red and Assiniboine Rivers, as a rule

^s Probably *E. Gelidus*. (F. J.)

in the pools formed where the snow melts...

On June 1, 1920 Dr. A. G. Huntsman, of Toronto, collected twelve specimens of *Eubranchipus gelidus* in shallow sloughs near Wetaskiwin, Alberta (near Edmonton). One of these is an adult male, the others are females, mostly adults, and with ripe eggs.

Together with the *Streptocephalus coloradensis* (see below) these are the first records of fairy-shrimps from western Canada.

On the Canadian Arctic Expedition I found in a large shallow pond on top of a ridge at Bernard Harbour, N.W.T., a number of fairy shrimps (both sexes) of a peculiar species, (*Artemiopsis Stefanssonii*) not known before. Another species (*A. bungei* Sars) is known from Siberia and the New Siberian Islands. The new species will be described and figured in detail in the reports from the said expedition (Vol. VII, Part G), so I need only give a summary of my observations on it here. I first observed it on October 6, 1915, in a one foot deep pond which then had seven inches of ice covering it, but in spite of this the fairy shrimps were very active. In size they were from seven to eleven mm. long, the females being generally a little longer than the males, but all were apparently adult and ripe. They belong to the group of fairy shrimps with eleven pairs of progenital limbs, and the male had its claspers in the form of powerful, sickle-shaped, terminal parts (with two spines projecting some distances from their tips), projecting from a swollen basal part, besides somewhat spiral shaped protruding genital organs, while the female had a very large elliptical egg-sack with olive-brown eggs and a couple of curved processes projecting laterally from the dorsal side of the genital segments. Especially do these female characters remind one decidedly of *Embranchipus gelidus*, but the shape of the male claspers and genitalia, together with the absence of accessory copulatory organs (frontal processes, etc.), distinguish them at a glance. In color the males were paler than the females, the latter were orange-red-brown and transparent posteriorly. When found these fairy shrimps were mostly in coitu, the males holding the fe-

males by their claspers dorsally just above the egg-sack and aiding them in locomotion.⁹ Males not in copula would soon attack one of the females, which were present in larger numbers than the males, and remain with her as long as copulation lasted. I kept these fairy shrimps alive for some days in a jar, but finally they all died, nor did I have any success in trying to rear the eggs during the winter and next spring. What is apparently the metanauplii (2-3mm.) of this species I found next summer (July 3, 1916) in the same pond; at that date the *Branchinecta paludosa* metanauplii were considerably larger, so apparently the new species is somewhat later (a couple of weeks) in its development (hatching). On the other hand it lasts longer in the fall, no *Branchinecta* being met with after the freshwater freezes in September on this coast, while the other fairy shrimp, as mentioned, was secured as late as the end of the first week of October. Owing to the shallowness of the pond, however, they probably would not live many days longer, but be killed off when the water froze to the bottom before the middle of the month. I only found the new species in the pond mentioned, and the locality (Bernard Harbour) is the only one in which it has been met with so far. In this connection it is interesting to note that De Dées (1910) says in his account of the Siberian species (*A. bungei*) of the same genus, that it apparently can withstand a very cold water (about 1° Réaumur), and at least some of the specimens were secured on October 10 (1886). This conforms remarkably well with my observations on the new Canadian arctic species (*A. Stefanssonii*.)

Dr. A. G. Huntsman of Toronto has recently sent me four adult (about 2½ cm. long) fairy-shrimps, one female, the rest males, which he collected on June 11, 1920, in shallow sloughs, three miles northeast of Medicine Hat, Alta. I have identified them as *Streptocephalus coloradensis* Dodds, and Prof. A. S. Pearse of the University of Wisconsin has verified my determination of this as of other uncommon Canadian Phyllopods. These *Streptocephalus* occurred together with *Lepidurus couesii*,

⁹ Though the principal swimming was done by the female.

and the two "clam-shrimps", *Estheria mexicana* and *Limnetis gouldii*. The female had ripe eggs in its long, tapering ¹⁰ ovisac, and the three males had the copulatory organs well developed. This is the first record of this family in Canada; it is known in the United States only from Colorado, from which state it was originally described and figured by Dodds in 1916. The family (and genus) is characterized by the male having very long, tortuous and three-jointed claspers (second antennæ), with particularly the terminal joint subdivided into branches and

¹⁰ Thus distinguished from the female *B. paludosa*.

appendages (see figure by Cockerell, 1912). The male has the protruding genitalia rather small and slender; while with the female the second pair of antennæ hardly exceeds the first pair in length.

This new Canadian record makes it very probable that the species also occurs in Wyoming and Montana. In Colorado it occurs, according to Dodds (Proc. U. S. N. M. Vol. 49), on the eastern slope of the Rocky Mountains (Eldorado and Fort Collins), up to an elevation of almost 9,000 feet. The new record at Medicine Hat (which lies at an elevation of about 2,135 feet) apparently gives the lowest known altitude of the occurrence of the species.

(To be concluded.)

SOME NOTES ON THE BELTED KINGFISHER.

BY PROF. WILLIAM ROWAN, UNIVERSITY OF ALBERTA, EDMONTON.

The following notes were obtained at the new Biological Station of the Manitoba University on the shores of Indian Bay, Shoal Lake, Lake of the Woods, Man., between the 15th of June and the 4th of August 1920. The Biological Station is placed in the wildest scenery right on the shores of the bay, 100 miles east of Winnipeg. Most of the intervening country is muskeg and little of it is settled. The University buildings consist of two bungalows, and there are half a dozen other buildings inhabited by employees of the Greater Winnipeg Water District and hands connected with the little private railway which supplies them with food and weekly mail bag. The birds were therefore studied in a comparatively undisturbed and natural environment.

The shores of the lake are entirely rocky and thickly clothed with trees, mainly poplars. The scores of islands in Shoal Lake are similarly of solid rock, covered with extremely dense vegetation. On our arrival the nesting sites of the Kingfisher, one of the most abundant birds, was a problem, for even his colossal beak is useless when it comes to working in rock. No amount of searching or watching from the canoe along the banks revealed a single nesting hole. The continual passage, however, of Kingfishers from the shores of the lake to the banks of a large gravel pit—a relie of the water works operations—

put us on the right track and on the third day we had found the first nest. The holes are so characteristic that, having found one, others were easy, and a half hour's search revealed nearly a dozen nests in the two banks. The pit is about a quarter of a mile in length and some hundred yards across and the banks are mainly of soft sand. The only other birds nesting in holes here are Rough-Winged Swallows, and of these there is but one small colony with their little holes characteristically close to one another. The Kingfisher's holes are much larger, being six or seven inches across, and all are at the tops of the banks. Some are old, others in use. The latter can immediately be detected by the curious double track of the two feet of the parents worn into the soft sand and running from the entrance inwards. There is no offensive smell however, and no filth oozing out, two characteristics of some other species of Kingfisher. The burrow is as a rule between two and three feet in length, horizontal and straight. The terminal chamber is very roomy, as indeed it must be to hold the seven or eight large young. It is invariably sunk beneath the level of the run, and if dug out is found to have the wall dripping and reeking with filth. The young, when ready to fly, have an extremely offensive smell, their breast and belly feathers being plastered together with caked sand.

One or two exceptions to the straight run were found in cases where the birds had struck a large root far in while burrowing. If this should happen early in the proceedings the hole is apparently abandoned. Small roots are broken and cleared out. No fish bones were found in any of the chambers examined.

This sand pit, a quarter of a mile from the lake, was the favourite nesting ground. One or two burrows were found in the soft humus and leaf mould covering the islands, but these were all comparatively short. In one case there were no less than three attempted and abandoned holes round the successful one, either big roots or rock having formed an impassable barrier. Other nests were found in small sand pits dug in various parts of the forest. Some of these were a mile from the lake and measured but a few yards across with the banks only 18 inches high. Nearly all held a single Kingfisher family and each had one or two holes used in previous years.

Most of the eggs had hatched by the time of our arrival. A full clutch appears to consist of eight, the average size being 3.43×2.64 centimetres. It is hard to tell one end from the other.

The fledging period is very long, probably more than five weeks. The young are blind when first hatched and remain so for at least a week. At about a fortnight they are bristling with quills, which, during the third week, almost simultaneously "burst into bloom". A family of seven was photographed at the end of about the fourth week. A week later they left the nest one by one, two days elapsing between the departure of the first and the last. They were escorted almost at once to the lake. During the second week of July the lake's edge was alive with single young, scattered here and there, sitting stupidly by themselves or chasing a parent for food. A week later each family was reuniting and the young beginning to fish for themselves. I have seen four young and an adult on a single perch, the young presumably taking fishing lessons.

In the nest the young "churr" when hungry. This resembles the adult rattle, except that it is very much faster and on a minute scale. The young can produce the

adult edition at an early age if taken from the nest and sufficiently aroused. As with the British Kingfisher, the hind toe is kept tightly pressed against the back of the leg during the fledging period. The legs are flesh coloured.

The Belted Kingfisher is a decidedly noisy bird. No matter whether disturbed by human beings, other mammals or the larger raptors it always rattles loud and long. When the young have just left the nest and are being taught their trade, the old birds are at their noisiest. At the nest there are always one or two favourite perches on which the birds may settle before going to the hole. These are usually at the top of some tall tree. Nearly always the bird lands there to the accompaniment of a loud tattoo, whether there is danger in sight or not. Their attitudes in perching vary of course, but I should say the most characteristic is with the tail, which is often flicked up, held level, and the ragged crest partially erect. This ornament always looks patchy when raised. It is thicker, or seemingly so in the young, the feathers being shorter and stouter. The adult plumages are too well known to need description. The juvenile female has the flanks more freely sprinkled with brown than the young male. Both have the grey chest band tipped with brown. Some of the young males show decided indications of the brown lower chest band of the female, but this is a variable feature. The percentage of males per brood appears to be considerably higher than females.

The food consists mainly of fish, though crayfish, abundant in the shallow edges, are extensively eaten and are also fed to the young. They are taken whole to the nest. Fish, if big, are held in the middle and slapped on a branch till dead or stunned. Fishing is mainly done after the manner of Terns, the Kingfishers hovering in the air and then diving; but they also commonly dive from perches, though I have only seen crayfish obtained in this way. Owing to the rocky nature of the lake's edge, suitable perches are few, and these are in continual use. Both birds hunt for the young (and I believe take turns at incubation), and I have seen the cock bring food for the hen when she was brooding the newly hatched young.

Photographing the birds entering and leaving the nest was attempted but with scant success owing to the disappointing qualities of the only so-called fast plates available when we left Winnipeg. Despite the most brilliant sunshine a bird photographer could wish for, an exposure of 1/10th second at an aperture of F6 was the shortest possible to get a decently exposed negative. The movements of the bird were far too quick for such a time exposure. The heat of the little sandpit in the full glare of the July sun (shade temperature 90deg. odd) was almost unbearable, perspiration dripping steadily off

every inch of one's body during the whole of the time in the blind. Ants were countless, a hearty biting variety; "bulldogs" and other flies took each their ounce of flesh at frequent intervals; mosquitoes in their battalions bit through shirt and trousers alike, yet movement was impossible. The birds proved good subjects, both male and female bringing food to the half-grown young at regular intervals of about half an hour, but owing to the poor plates the camera was given up in disgust and most of the three or four days spent in the hide were devoted to observation and sketching.

THE KING versus RUSSEL C. CLARK.

This case has attracted such wide attention among naturalists, sportsmen, and all who are interested in the conservation of the Wild Life of the continent that a summary of it is not out of place here. If any reader desires the full text of the decision it may be obtained from the Commissioner, Canadian National Parks Branch, Ottawa.

On March 31, 1920, Russell C. Clark was apprehended near Mount Stewart, P.E.I., by P. G. Rowe, a migratory Bird Warden. At the time Mr. Clark had in his possession a boat, a shot-gun, and fourteen Canada Geese. He was tried before a local magistrate and the case dismissed.

Then the case came before the Supreme Court of Prince Edward Island on an appeal from the dismissal.

It was suggested by the defence that the Migratory Birds Convention Act was ultra vires the Federal Legislature as regards birds found in the province of Prince Edward Island, they being the property of the Province, and the question being raised was considered.

The judgment of the court states in part that this Act was passed to give effect to a Treaty for the Protection of Migratory Birds which traverse Canada and the United States, the title whereof is not considered vested in any particular part of either country.

The Treaty determines certain close seasons and it is by it agreed that appropriate legislation for insuring its execution should be enacted by the law-making bodies of the High Contracting Powers. This has been

done by the Federal Parliament in the Act of 7, 8, George V, thus performing an obligation of this Dominion arising under a Treaty between the Empire and a foreign power.

Under the British North America Act, 1867, the Parliament of Canada is given exclusive power to make laws in this respect.

It is pointed out in the judgment that similar legislation has been enacted by an Act of Congress of the United States of America, and in the case the State of Missouri, Appellant, and Ray P. Holland, United States Game Warden, the Supreme Court of the United States held that the Migratory Birds named in the Act were only transitorily within any State, having no permanent habitat therein, and that they could be protected by national action in concert with that of another power.

The judgment goes on to state that the Canada Goose is indisputably a migratory bird traversing the Continent of America from the frozen North to the Gulf of Mexico and that it is only at certain seasons to be found in any particular part thereof.

Uniform protection for such birds is not possible for any Provincial Legislature although the killing and sale of such birds as between the Province and its people may be regulated by the Provincial Legislature. Uniform protection for these birds can only be accomplished "by national action in concert with another power" and here the Supreme Court of Prince Edward

Island quotes from the decision of the Supreme Court of the United States.

The decision is summed up with a statement to the effect that the Migratory Birds Convention Act is *intra vires* of the Dominion Parliament under the general power of the Federal Parliament to make laws for the order and good government of Canada as well as under its power to carry out Treaty obligations by legislation and any conflicting Provincial Legislation is abrogated by it.

The magistrate's order for dismissal was set aside and the appeal allowed with costs. Under this decision Mr. Clark's gun was forfeited, a fine of \$10.00 imposed, and he had to pay the court costs.

It will be of interest to those concerned in the protection of the birds of the Continent to learn from this decision that the Federal Legislation for bird protection in Canada is legally sound.

NOTES AND OBSERVATIONS.

ANIMAL BEHAVIOR AS A FACTOR IN THE FORMATION OF BONE BEDS.

The occurrence of fossil vertebrates massed together in considerable numbers in restricted areas is a familiar fact to experienced collectors. These aggregations are usually spoken of as bone beds or quarries by collectors of fossils. Various theories have been proposed to account for the surprising abundance of vertebrate remains in certain quarries and their absence or scarcity outside these limited areas. Different kinds of bone beds evidently require different explanations.

In the case of bone beds in which only a single species or closely associated species are present, the accumulation of the remains of numerous individuals may be explained by the peculiar behavior of some animals of the present time on the approach of death from starvation or freezing. Such bone beds appear to be common in the Cretaceous. Mr. C. M. Sternberg is acquainted with "no less than 7 bone beds in which only horned dinosaurs are represented."¹

Darwin has described the curious instinct of the guanaco of South America which leads it to "have favorite spots for lying down to die. On the banks of the St. Cruz in certain circumscribed spaces which were generally bushy and all near the river the ground was actually white with bones."²

A western correspondent, Mr. R. A. Brooks, has given me in a letter a descrip-

tion of the behavior of cattle and buffalo on the western plains under the stress of cold, starvation and fright, which clearly indicates how large masses of the bones of these animals have been accumulated. Mr. Brooks states that: "During the hard winter of 1906-07 thousands of head of cattle perished from starvation and cold. I remember well how some of them died. The first cow to die usually felt it coming and left the bunch or herd and slowly made its way to a lonely place, generally a clump of brush or a coulée, and lying down simply waited to die. The next one feeling her time approaching followed in the tracks of the first one, and died close beside her and this was kept up until there were no more, or relief came. At the U Ranch in the Hands-Hills, central Alberta, the owner showed me a coulée where 450 head of his cattle died. This pile of bones actually made a dam across the ravine. Within half a mile was another pile of bones, all that was left of 675 head. Everyone acted the same way. The owners told me that hardly half a dozen died separately and these were on their way to the dying place.

"There is also another place on the Beaver Dam river where countless buffalo died of thirst during a dry year. An old Indian told me that long ago there had been nearly three years of rainless seasons. All the rivers were dry as well as most of the springs. But one kept flowing very freely on the banks of the Beaver Dam. When a herd of

¹ E. M. Kindle, *Inequalities of Sedimentation*, Jour. of Geol., Vol. 27, p. 359, 1919.

² Chas. Darwin, *The Voyage of the Beagle*, p. 172.

buffalo would come near enough to scent this, there was a stampede for it and the ones behind would literally climb over the front ones and trample each other to death. Prairie fires also were the cause of many buffalo bones at the bottom of cliffs, and it is well known here that in the early days the Indians themselves used to stampede herds of buffalo over the cliffs."

This account of the behavior of western cattle under the conditions described, and the mass destruction of the buffalo when acting under stampede excitement, gives an insight into phases of animal behavior which may have been a factor in the formation of some fossil bone beds. It may be that the Alberta dinosaurs of Cretaceous times when famine came, like the Alberta cattle of today, sought a common drying ground.

E. M. KINDLE.

VESPUULA DIABOLICA.—During the past summer (1920) *Vespula diabolica* was extremely abundant in northern Frontenac County, Ontario. In August and September there were hundreds of this species about my camp at Lake Missanag, where during the last four years only a few individuals had been present. Anything sweet which was exposed even for a few minutes became a rendez-vous for these wasps and was soon a mass of buzzing black and yellow. In the woods they were everywhere in evidence. From various sources I have heard of the great abundance of "hornets" in the northern districts of Ontario during the past summer, and in all probability these reports refer to the present species.

The statements in the literature concerning the nest of this species are conflicting. According to Ashmead it nests in stumps. Lutz, after describing the nests of *Vespa crabro* and *Vespula maculata*, says: "The remainder of our species, the Yellow-jackets, usually make smaller nests and place them either near or under the ground." Plate 3 in "The Hymenoptera of Connecticut" shows a small paper nest of this species apparently attached to a beam. I came across several nests of this species and all were suspended from the limbs of trees; they are large paper structures, and

seem to be almost identical with those of *Vespula maculata*.

The larvae are 12 mm. long and 5 mm. in diameter at the widest part, whitish in colour, and hang head downwards, suspended by the sticky disc at the posterior end of the body. The pupae at first are white, with black eyes; later the thorax becomes dark, and the black bands appear on the abdominal segments before the wings have developed beyond the wing-pad stage.

Vespula diabolica exhibits a considerable variation in size and marking. Different individuals range from 13 to 16 mm. in length. In some individuals the black bands on the anterior portion of the abdominal segments are very wide, in others they are comparatively narrow. In some the black point on the first abdominal segment projects much further back than in others, sometimes almost cutting the yellow posterior border of that segment in two. I found such a difference in respect to marking that I sent three specimens to Dr. L. O. Howard for confirmation of identification. Dr. Howard reports that Mr. Rohwer determines them all as *V. diabolica*. Two of these specimens were taken from the same nest.

This species appears to feed very largely, if not entirely, upon vegetable substances. Sweetish sap of any kind is taken with avidity. Fruits are bitten into and the pulp devoured or carried off. Kernels of corn in the late milk stage are cut into and pieces about a millimetre square are carried off. The material carried off is probably food for the larvae, although I was not able to prove this point conclusively.

Vespula diabolica does not merit its specific name by reason of its disposition, since it is not at all pugnacious as far as man is concerned. Unlike some of the other Vespoidea no amount of striking at it seems to arouse its ire, and one individual crawled up my sleeve and came out at the neck of my shirt without stinging. In fact only if seized or crushed does it sting. Its sting is not particularly severe, the burning sensation soon passing off and leaving an itching which persists for a couple of days. It is capable of stinging twice in rapid succession. They are rather quarrelsome among themselves, and when

many individuals are taking food from a common source they have frequent combats, two individuals grappling, rolling over and over, and using their mandibles but never their stings.

This species finds its food by the sense of smell, as was shown by a few experiments which I performed. Food hidden from its sight was readily discovered, but similarly-coloured objects without odour were not visited.

A. BROOKER KLUGH.

A GULL IN NIAGARA RAPIDS.—On the afternoon of February 16, 1921, at Niagara Falls, Ontario, I was watching through binoculars (x3) Herring Gulls, (*Larus argentatus*, Pont.) and Ring-billed Gulls (*Larus delawarensis* Ord.) which were picking bits of food out of the rapids of the Niagara River. So skilfully did they do their work that they seemed to receive on their plumage not even a drop of spray as they dipped repeatedly to the surface of the rough water. But one adult Gull, of which species I cannot say, must have made an error as he sought to obtain some object in the rapids just above the brink of the Canadian Falls, for, while I watched with my glasses focussed on him, he was suddenly seized by the foaming river, and in a flash he disappeared beneath the surface. I concluded that his career was ended and that in a few moments more he would go over the falls. Hardly had I had time for the thought, however, when, several feet down-stream from the place where he had been submerged, the Gull reappeared and succeeded in taking flight. Apparently the rough handling which he must have received while beneath the surface of the rapids had forced water into his usually water-proof plumage, for, as he flew slowly away, he was seen to shake himself vigorously, as a dog will do on coming out of the water.

HARRISON F. LEWIS.

THE GREATER SNOW GOOSE.—Most recent writers on the water-fowl of north-eastern North America speak of the Greater Snow Goose (*Chen hyperboreus nivalis* (Forst.)) as a rare bird in that area and appear to pay little or no attention to the fact that Mr. C. E. Dionne, on pages 109-

110 of his book, "Les Oiseaux de la Province de Québec" (1906), states of this subspecies that it "is very common and often occurs in considerable flocks in spring and fall in certain places on our shores, notably at St. Joachim, where I have seen flocks of three or four thousand individuals, on the Island of Orleans, and as far as the Sea-Wolves' Batture". The three points mentioned by Mr. Dionne are within sight of one another. In their vicinity probably all the Greater Snow Geese in existence in a wild state gather each spring and autumn. From the independent statements of various careful observers, I should conclude that their number is now about five or six thousand. When I visited St. Joachim on March 31, 1921, I saw about two thousand Greater Snow Geese there and was told that the maximum number would be present about ten days later. They are well protected by a resident warden maintained by the Cap Tourmente Fish and Game Club.

HARRISON F. LEWIS.

THE TOWN OF YARMOUTH, N.S., BUYS A BIRD SANCTUARY.

The municipality of the Town of Yarmouth has purchased a Bird Sanctuary. This was not an area suitable for a park or other similar purposes, but was the Island in Lake George where the colony of Great Black-backed Gulls nest. It is of use for Bird Sanctuary purposes only, and this colony of Gulls, so ably described by Mr. Harrison F. Lewis, will now be protected, and will serve as an additional attraction for bird-lovers in the Yarmouth vicinity.

The publication of Mr. Lewis'¹ article in the "Naturalist" assisted in crystallizing local public opinion on this question for it was extensively quoted in the Yarmouth press at the time that the matter was under consideration.

The only step necessary to complete the Sanctuary will be the formal setting aside of the area by the provincial authorities.

Large cities have parks where land birds find refuge and may be studied by the student; these are bird sanctuaries with-

¹ Canadian Field-Naturalist Sept. 1920.

out doubt; but the town of Yarmouth has pointed the way to other Canadian municipalities by purchasing an area solely because the birds found it suitable. What a splendid impetus would be given to bird protection if every town that had such a bird colony near it were to extend its influence officially in the interest of its bird neighbours. In the West the care of a prairie slough suitable for wild fowl as the town bird sanctuary would be a worthy line of endeavour for any town or city. The idea could be combined with the present laudable desire of many municipalities in the Western Provinces to reserve park lands in their immediate vicinity.

HOYES LLOYD.

BOOK REVIEWS.

THE AUK, No. 3, JULY, 1920.

Notes on Some American Ducks, by Allan Brooks, 2 plates, pp. 353-367.

Ornithologists are not as a rule sportsmen, and undoubtedly their greatest weakness is a lack of personal familiarity with water-fowl. The difficulty of obtaining material for the study of these birds at the most interesting and illuminating time of the year (the close season) is somewhat to blame for this, but the feeling that birds so systematically hunted must already be well known has tended to turn the attention of ornithologists towards fields that seem to present greater promise. The fact is, however, that the very few sportsmen and shooters, who know any more about ducks than is sufficient to make occasional bags at certain seasons of the year, are seldom fitted either by scientific training or inclination to present their observations in a proper manner. While many old hunters are mines of valuable information, and our sporting magazines are filled with more or less accurate accounts of the habits and characters of wild fowl, but little of scientific worth has been made public from these sources in America and it takes the closest discrimination to separate that little from the fiction in which it is buried.

This paper is therefore of great value as it comes from a man who knows his subject from both the sportsman's and the naturalist's standpoint. It consists of various notes on nine species of British Colum-

FRESHWATER CRUSTACEA FROM CANADA. — Since writing my articles on this subject (see *Can. Field-Naturalist*, October and November, 1920) I have had the opportunity of examining some samples of freshwater invertebrates collected by Dr. A. G. Huntsman in southern New Brunswick and Nova Scotia in the fall of 1920. They contained the following new records of Amphipods and Isopods:—

Hyalella knickerbockeri, Bate (*H. Azteca* Sauss): Several young ones from Lock Lomond, near St. John, N.B., October 7, 1920, and from Solomon Lake, near Yarmouth, N.S., October 4, 1920. *Asellus communis*, Say: Several young ones from Solomon Lake, N.S., October 4, 1920.

FRITS JOHANSEN.

bian ducks. They are too varied to be more than mentioned here, except a detailed analysis of the difference between the American and Barrow's Golden-eye which is treated at length, with plates showing courtship attitudes of the latter. It is a coincidence that the author calls attention to the differential features of bill and wind-pipe that the present reviewer discussed in a late number of this journal. Courtship in Birds, by Chs. W. Townsend, pp. 380-393.

This is a philosophic study of the strange courtship dances and actions that are indulged in by many birds. The author has made a special study of these and no one is better qualified to generalize upon them.

Ontario Bird Notes, by J. H. Fleming and Hoyes Lloyd, pp. 429-439.

A résumé of the ornithological developments in Ontario since the publication of Fleming's Birds of Toronto, *Auk*, XXIII and XXIV, (1906-1907). It includes notes on some 71 species.

Seventeenth Supplement to the American Ornithologist's Union Check List of North American Birds, by the Committee on Nomenclature, consisting of Witmer Stone, H. C. Oberholser, Jonathan Dwight, T. S. Palmer and Chas. W. Richmond, pp. 439-449.

When the last Check-list was published in 1910 it was proposed to issue revised

editions every decade, leaving the subject of changes to rest from official action in the interim. This would give us ten year intervals of approximate stability instead of a constant and progressive series of change. 1920 was the year for the accumulated proposals of change to be considered and decided upon and a new Check-list published. However, one of the important matters under consideration at the 1919 annual meeting was the proposal from the British Ornithologist's Union that the two associations should unite in a check-list of birds of the world in which we were to assume charge of the part covering America.

It was recognized that, however desirable this might be, it brought to the fore the fundamental differences between European and American practice, but it was hoped that grounds of agreement could be arrived at. Harmonizing of opposed views and the mutual concessions necessary to agreement is a difficult matter, and though the publication of a check-list has been held up, that object of the negotiations has not yet been arrived at. The committee on Nomenclature has been busy, however, and has decided that the results of their findings should no longer be withheld. Considering that this supplement is "a considerable part" of ten years accumulations it is not as bad as the annual installments of possibilities led us to fear. The additions and changes number 32, the rejections 35. Those affecting the names of Canadian birds are as follows:

GENERIC CHANGES.

Megalestris Bonaparte, Skut, becomes *Catharacta* Brunnich.

Hydrochelidon Boie, Black Tern, becomes *Chlidonias* Rafinesque.

Thalassidroma Vigors, Storm Petrel, becomes *Hydrobates* Boie.

Aestrelata Bonaparte, Petrels, becomes *Pterodroma* Bonaparte.

Clangula Oken, Goldeneye, becomes *Glaucionetta* Bonaparte.

Herolda Stephens, Harlequin, becomes *Clangula* Leach.

Maerorhamphus Forster, Dowitcher, becomes *Limnodromus* Wied.

Calidris Illiger, Sanderling, becomes *Crocethia* Billberg.

Helodromas Kaup, Solitary Sandpiper, becomes *Tringa* Linnaeus.

Heteractitis Stejneger, Wandering Tattler, becomes *Heteroscelus* Baird.

Charadrius Linnaeus, Golden Plovers, becomes *Pluvialis* Brisson.

Aegialitis Boie, Ring Plovers, becomes *Charadrius* Linnaeus.

Catharista Vieillot, Black Vulture, becomes *Coragyps* Geoffroy.

Aluco Fleming, Barn Owls, becomes *Tyto* Billberg.

Saricola Bechstein, Wheatears, becomes *Oenanthe* Vieillot.

The Gannet, *Sula Bassana* (Linnaeus), is placed in another genus and becomes *Moris bassana* (Linnaeus).

SPECIFIC AND SUBSPECIFIC CHANGES.

Calidris leucophaea Pallas, Sanderling, becomes *Crocethia alba* Pallas.

Vermivora rubricapilla Wilson, ashville Warbler, becomes *Vermivora ruficapilla* Wilson.

Compsothlypis americana usnea Brewster, Northern Parula Warbler, becomes *Compsothlypis americana pusilla* Wilson.

It is evident from this that many of our oldest and most familiar names have gone into synonymy but it is also to be noted that the Committee have dropped diphthongs in the spelling which is an advance in the direction of simplicity and a relief to the printer who is without an unlimited font.

A list of 35 rejections follows, which many of us may wish twice as long.

Under "General Notes."

B. H. Swales, p. 463, records a Hooded Warbler seen on Belle Isle in the Detroit River, Mich., May 6, 1920. This is only a fraction of a mile from the Canadian boundary and the record is of interest in connection with our few records of the species in south-western Ontario.

Harrison F. Lewis, pp. 464-465, gives a very circumstantial account of a Blue-gray Gnatcatcher seen at Quebec City, May 18, 1920. There is another old but poorly substantiated record for this species at Montreal. Mr. Lewis' description of its characteristic tail twitching and repeated hoarse note is very convincing and places the occurrence on as firm a basis as is possible for a sight record of so unusual an event.

Under "Recent Literature" is reviewed, pp. 479-480, On the Nest and Eggs of the Common Tern (*S. fluvialis*), A Comparative Study, by Wm. Rowan, E. Wolf and P. L. Sulman, assisted by Messrs. Pearson, Isaacs, Elderton and Tildsley. *Biomctrika*, Vol. XII, 1919, pp. 308-354, 5 plates.

This is a mathematical correlation of the exceedingly variable characters of the eggs and nests of this species with their environment, to detect the relation if any between these apparently hap-hazard factors. In the course of the work many hundred eggs were examined and measured and compared with their immediate surroundings. While results are not conclusive on any one point they are suggestive of lines of future investigation. Thus, whilst there was more uniformity, the eggs averaged larger in the good season of 1914 than in the poor one of 1913. This may possibly have been due to the stricter elimination of the weaker birds or those that departed farthest from the optimum type the previous year. Another point brought out, but the meaning of which does not seem clear, was that the most spherical eggs were found in the most carelessly built nests. Much other food for thought is suggested that we have not space to mention. This is work that may well be carried on by those few who are favorably situated to examine large rookeries of variable species. The results, even if negative, are worth while, for it is as much a part of scientific pathfinding to locate the blind alleys as to mark the highway. In reply to criticism that has already been raised it may be remarked that the senior author has informed us that apart from the momentary and unavoidable fright caused by the intrusion of the investigators the birds were not disturbed and the great array of tabulated data was gathered without the necessary loss of an egg.

Under "Correspondence".

W. E. Saunders and J. H. Fleming address a letter to the Editor, proposing that in future, at the Annual Meetings of the A. O. U., each member shall pay for his or her own luncheons instead of being entertained as guests by members of local organizations. It was felt that, however hospitable and willing these organizations have been in the past, it is throwing an

annually increasing burden upon them that is greater than should be accepted. It may be remarked that this was followed by a circular letter to the membership, and, as a result, at the late Washington meeting the suggestion was acted upon.

Pp. 499-505 are taken up with a discussion on Popular Nomenclature, originating independently with Wm. Rowan and Harrison F. Lewis, and replied to by the Editor, Witmer Stone.

Mr. Rowan objects to the use of names like Robin and Sparrow Hawk to American species when the terms are preoccupied by entirely different Old World forms. He suggests that we return to the system in force before the 1910 Check List of prefixing the adjective American to them.

Mr. Lewis presents five propositions for the making of popular bird names:

- 1.—Provide for specific as well as sub-specific names.
- 2.—Avoidance of clumsy names.
- 3.—Changing inappropriate or misleading names.
- 4.—Avoidance of the names of people in name construction.
- 5.—The use of modifiers to group names when used for individual members of such group.

Mr. Stone, whilst dealing sympathetically with most of these views, proclaims the impossibility of applying a "code" to the construction of popular names, fearing the introduction of "book names" and citing cases where such have failed of general adoption. In the spirit of Thompson Seton's apt phrase "the genius of the language" he objects to Rowan's proposal declaring in substance that to Americans *Planesticus migratorius* is the Robin and no other name will be generally adopted. He does, however, approve of Lewis' fifth proposition.

Whilst a hard and fast code such as is applied to scientific names (and incidentally keeps shuffling our names about) may not seem advisable and considerable latitude must be given to established popular usage, it does seem that some such principles might well be kept in mind. The Check-list is now a mass of "book names" of the bookiest kind, and it does not seem that it would put any great inconvenience upon the general public were the most ob-

surd of them replaced by others of more popular appeal. Names well established in popular usage need not be disturbed, but it does not seem likely that (1) calling the first described subspecies of the Palm Warbler, the Interior Palm Warbler; (2) shortening Arctic Three-toed Woodpecker to Arctic Woodpecker; (3) changing Arctic Towhee to Northern Towhee; (4) Brunnich's Murre to Thick-billed Murre; (5) and Chickadee to Black-capped Chickadee would arouse any general protest from the public.

It is difficult to understand Mr. Stone's attitude in regard to the prefix American to Robin, Sparrow Hawk, Redstart and others. Of course to those who know and love him *Planesticus migratorius* will always be regarded as *the robin* in spite of check lists and committees to the contrary, but colloquial use need not debar the creation of a more formal title for mixed audiences. If we speak of a certain well-known ornithologist in public or where confusion of identity might arise we are careful to use his full formal name, e.g. Dr. Witmer Stone, and on proper occasion may add a string of letters in due form. In general private discussion, I fear that the single name "Stone" is often used, whilst among his intimates I think I have heard the simple "Witmer" repeated and a nick-name may even be surmised. Yet all these forms are without prejudice to the full formal title in the check-list of American men of science. There is no reason why the same would not prove true of the American Robin or any other similar bird.

The fact is that *Planesticus migratorius* is not, nor ever can be, The Robin any more than it can be an elephant or any thing else that it is not. Calling it so colloquially or as a figure of speech may be convenient and expressive where the use is plain, but it is not suitable for formal occasions or where the purpose is obscure. It may be said that it is the bird called Robin in America or the American Robin, but it is not *the* Robin any more than the Canada Goose is a Bustard because French Canadians call it Outard. These are questions of fact that cannot be set aside by specialist committees. The suggestion that if *Planesticus migratorius* is the American Robin, *Erithocus rubecula* is the European

Robin is hardly logical, as we can hardly call on Europe to qualify itself when it has the acknowledged priority; the onus of distinction lies with us.

Finally I would take exception to Mr. Stone's proposal that the names of sub-specifically divided species be made plural, as *Melospiza melodia*, the Song Sparrows. This is a retrograde step. A tree is a tree no matter how many branches it has, and *Melospiza melodia* is a species, no matter how many subspecies may be found within its limits. It is not a complex of individual disconnected units but an individual unit itself, more or less branched and containing plans of possible future cleavage; but until that cleavage occurs an individual entity for all that. To declare otherwise is to support a false and obsolete doctrine without in any way clarifying popular concepts.

Notes and News contains, p. 511, the obituary notice for Dr. C. Gordon Hewitt, who died at Ottawa, Feb. 29, 1920.

NO. 4, OCTOBER, 1920.

Limicoline Voices, by J. T. Nichols, pp. 519-540.

This is an interesting paper dealing with the voices and call notes of the waders, the occasions of their use and probable meanings. It is largely philosophical in tone but no one interested in these birds in life should neglect studying it.

In The Haunts of Carn's Warbler, by C. W. Eifrig, pp. 551-558.

This paper, by one formerly closely associated with the *Ottawa Naturalist*, is a general account of the birds in south-western Maryland in 1918.

Pattern Development in Teal, by Glover M. Allen, pp. 258-264.

This paper was suggested by Kennard's description of the Southern Blue Winged Teal, (*Auk*, 1913). It is the presentation of a new theory of color placement based upon the above species. The author postulates certain superficial areas or centers from which color may spread. White is normally found only at the edges of these areas and is to be regarded morphologically as caused by restriction of color development, a passive rather than an active factor in pattern development.

Migration and Physical Proportions, a Preliminary Study, by C. K. Averill, pp. 572-579.

This is an application of mathematics to ornithological study, and is based upon series of measurements of various birds correlated with their migrational and flight habits. Birds of longest migration seem to have long wings, short tails and small bills and feet. The forked tail is an accompaniment of good flight powers. A possible explanation of this is suggested by Dr. J. T. Nichols in a later number of the National Geographic Magazine, where he calls attention to the forked tails of the speedier fish. His theory is that the center of the tail is the meeting point of the stream line currents proceeding along the body and that the cutting out of the tail here reduces drag. It also appears in current literature that a remarkably speedy motor boat has lately been built by cutting away the underbody aft in an analogous fashion. It would seem that the effect produced in water currents would probably be seen in air movement with a result proportional to the reduced density of the medium. The forked tail may have a greater meaning than has heretofore been imagined. Mr. Averill has suggested a promising line of investigation.

Under "General Notes" are the following:

The Willet in Nova Scotia, pp. 581-582.

Breeding of the Semipalmated Plover in Yarmouth Co., N.S., pp. 583-584.

The Black-poll'd Warbler and Bicknell's Thrush in Yarmouth Co., N.S., pp. 591-592.

Notes on the Acadian Sharp-tailed Sparrow, pp. 587-589.

The Singing of the Ruby-crowned Kinglet, pp. 594-596.

Notes from Seal Island, N.S., pp. 596-597.

All by Harrison F. Lewis.

The Willet in Nova Scotia, by Chas. W. Townsend, pp. 582-583.

Most of these are summarised by their titles. The Eastern Willet as a breeding bird seems to be increasing in Nova Scotia under the beneficial protection of the Mi-

gratory Birds Convention Act. It was only lately supposed to be nearly extinct but may after all come back again. For some time all Willets on the Atlantic coast were referred to the western form, but now it is on the cards for observers there to sharpen their eyesight once more and differentiate between them. All birds now can not be automatically referred to the Western as the only geographic possibility. Had not observers been but too willing to rely on geographical preconceptions in identifying we might have known some time ago that the Eastern Willet was still to be reckoned with.

Under "Recent Literature" the following papers are mentioned or reviewed.

The Eyes of the Burrowing Owl, with Special Reference to the Fundus Oculi, by Dr. Casey Wood, Reprinted from *Contributions to Medical and Biological Research, dedicated to Sir William Osler in Honor of his Seventieth Birthday by his pupils and Co-Workers*, pp. 819-823.

A new Jay from Alberta, by James Lee Peters, *Proc. New England Zool. Club*, VII, pp. 51-55.

This is a new subspecies of Canada Jay, *Perisoreus canadensis albescens*, described from Red Deer, Alta. from specimens in the Brewster collection now in the Museum of Comparative Zoology, Cambridge, Mass. It is declared to be paler than other known races.

Report of the Canadian Arctic Expedition, 1913-1918, Vol. IX, Part E., Acanthrocephala.

In this is described a new species of acanthrocephala, *Filicollis arcticus*, parasitic on the King Eider in the western Canadian Arctic. It is interesting to note that the King Eider does not carry the same infestation throughout its range. On opposite sides of the Arctic Circle it seems to be parasitized by acanthrocephala representing two distinct genera.

Notes on the Harlequin Duck (on British Columbian Coast), by Chas. E. Alford, *British Birds*, XIV, June, 1920.

The Trumpeter Swan in British Columbia, by Allan Brooks, *London Field*, July 31, 1920.





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THE EVENING GROSBEAK IN CANADA.

By P. A. TAVERNER.

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Ottawa, Canada.*

Perhaps to no American bird is there greater interest attached, aesthetic or scientific, than to the Evening Grosbeak, *Hesperiphona vespertina*. Appearing as it does in the dreariest season of the year, when birds are few and color absent from the landscape, its wonderful yellow color and plaintive whistle always attract attention and interest. Even those who rarely perceive unusual bird visitors note the appearance of the Evening Grosbeak, and the winters of its occurrence always call forth letters in the papers and floods of enquiry of the local ornithologist. Over and above its showy beauty in an empty landscape the very mystery that surrounds the bird piques our curiosity. For it comes only at irregular and unexpected intervals, and, after tarrying awhile, disappears into the unknown; nor with all our present knowledge of the movements of birds can we yet say authoritatively whence it comes or whither it goes. It is some late evidence on this point that has suggested the appropriateness of a partial review of our knowledge of the species at this time.

The species was first introduced to science and popular attention by W. Cooper, who, in 1825, in the *Annals of the Lyceum of Natural History of New York*, described a specimen obtained by H. R. Schoolcraft at Sault Ste. Marie, Michigan, on April 7, 1823. Schoolcraft was told that it was common at Fond du Lac and about the head of Lake Superior. Further information was obtained from Major Delafield, who noted the bird in August of the same year on the Savanna River, north-west from Lake Superior, where it visited his camp, singing only in the evenings. Impressed

by its mournful notes, Major Delafield inferred that it dwelt "in dark retreats and left them only at the approach of night." It was from this circumstance that the bird received its name *vespertina*.

For many years occurrences of the bird within the view of students were few and far between; they but whetted the scientific appetite for information without satisfying it. The earliest record of the species in south and south-western Ontario appears to have been the winter of 1854-55,¹ when birds were taken at Toronto, Hamilton and Woodstock. In 1866 Thomas Mellwraith² records hearing of them at Hamilton, though he himself did not actually see them. In 1879, in the *Bulletin of the Nuttall Ornithological Club*, Coues compiled a history of the species, but, as far as the east was concerned, he recorded little more than that it was a rare and erratic winter visitor south to the northern states, though commoner and more widely-diffused in the mountains of the west. Its first general appearance in large numbers in eastern Canada occurred in the winter of 1889 and 1890; this was made the subject of a full report in the *Transactions of the Canadian Institute* for 1891. The *Auk* and the *Ottawa Field-Naturalist* contain numerous notices of the species about this date that add to the records of its occurrence, though they furnish no new information. Meanwhile the Western Evening Grosbeak, *Hesperiphona vespertina montana*, had been described from New Mexico in 1879. It was discover-

¹ Fleming, *Auk*, xxiv, 1907, p. 78.

² Pro. and Comm. Essex Inst., V, 1866-67, pp. 79-96.

ed breeding in Arizona in 1884, in California in 1887, and eventually was found to nest locally in the western mountains as far north as British Columbia.³

Although considerable light has been thrown on the breeding of these western birds, our knowledge of those that visit us in the east has not advanced to the same degree. The Mackenzie and Athabasca valleys have been well worked, but no Evening Grosbeaks have been found there in summer. Preble failed to locate them in the Churchill River system, and the country south of Moose Factory on James Bay has often been traversed without result. There is still room for the species in unexplored Ungava, but its winter distribution seems to indicate a more western origin. L. O. Scott, both alone and in association with M. Bedson,⁴ reported the finding of nests just outside of Winnipeg; he repeated, too, some Indian assertions about the bird breeding in the Peace River district. Later S. S. Stansell⁵ reported nests near Edmonton, Alberta, and defended his statements when questioned. None of these records were taken seriously, as they came from localities where other men had worked without discovering corroborative evidence; but some of them at least may have to be reconsidered in view of the new data that was obtained last year. Albert Lano,⁶ for example, has reported that he saw the species in July and August, 1900 and 1901, in Aitkin Co. Minnesota; and Chas. E. Johnson⁷ has recorded them as present in Lake Co. of the same state during the corresponding months of 1914 and 1915. Most important of all, William Rowan⁸ found the birds at Gimli, Man., about forty miles north of Winnipeg, in late May and early June, 1920. They appeared to be mating at the time, and remained there until July and early August. On July 26 he took a bird of the year still being fed by its mother at Indian

Bay, Shoal Lake, on the Manitoba-Ontario boundary (not the lake of the same name north of Winnipeg). This is the first substantiated breeding record for the species away from the western mountain region. It may also be noted that the writer⁹ found the birds in late May, 1917, at the other Shoal Lake north of Winnipeg, not far west of Gimli; at the time, however, he regarded them merely as late migrants and in consequence made no systematic search for nests.

There is some evidence therefore to show that the nesting area of the Eastern Evening Grosbeak includes not only the country from which it was reported by Major Delafield in the original description of the species, but that it extends along the northern forest belt from Lake Superior to some point westward. It is true that Mr. D. Blakely of the Victoria Memorial Museum collected ornithological specimens throughout the season of 1919 on Lac Seul, Ont., about 125 miles east and a little north of Indian Bay, without seeing it, and that Capt. Angus Buchanan¹⁰ traversed the country between Prince Albert, Sask., and Reindeer Lake with equally negative results. But these apparently blank spaces in the range of the bird can be explained by the supposition that it is nearly as erratic in its summer as in its winter distribution, changing its breeding localities from summer to summer in the same way as some other northern species appear to do, for example, the Crossbills, the Pine Grosbeak and the Bohemian Waxwing. The Evening Grosbeak, in fact, does seem to be erratic in this respect in the west, where its breeding in any locality at one season is no surety that it will breed there the next, or that it bred there the season before. Such an irregularity would largely explain why we have isolated records that remain unverified by previous or later work in suspected or adjacent regions. Moreover the fact that the nests of the Evening Grosbeak are situated (in British Columbia at least) high in the taller evergreen trees and that the birds become retiring and suspicious in the breeding season further reduces the probability of find-

³ The history of this species will always be associated with the name of the young ornithologist Francis J. Bittwell, who was killed in the presence of his wife, during their honeymoon, while attempting to reach a nest of the Western Evening Grosbeak in New Mexico.

⁴ Ottawa Field-Naturalist, xiii, 1899-1900.

⁵ Auk, xxvi, 1909, pp. 390-400, and Ottawa Field-Naturalist, xxiii, 1909, pp. 125-127.

⁶ Auk, xxxvii, 1920, p. 455.

⁷ Ibid., pp. 541-551.

⁸ Ibid., pp. 585-586.

⁹ Can. Field-Naturalist, xxxiii, 1919, p. 14.

¹⁰ Fleming, Can. Field-Naturalist, xxxiii, 1919, pp. 109-113.

ing them at this time without a special search.

In regard to the winter range of the species, as contrasted with its summer range, there has been a decided change of late years, a change that is very apparent at Ottawa, but observable probably elsewhere as well. The old reports of the species would indicate that originally it was a very rare as well as a very erratic visitor, although numerous enough whenever it did come. Latterly, however, it has appeared so much more often that it can be regarded as almost regular. It is true that none have been seen this winter, but then this has been an unusual winter in every way, and if Evening Grosbeaks have not appeared, neither have other species upon whose presence we can more usually count. According to the record, while the Evening Grosbeak has gradually become more regular in the locality of Ottawa, other winter species such as the Pine Grosbeaks, the Crossbills, the Bohemian Waxwings, the Eastern Horned Larks, the Red-Polls and the Snow-Buntings have become much less so. A possible, even a probable explanation of this newly-acquired regularity of the Evening Grosbeaks may be found in the recent spread of the Manitoba maple, *Acer negundo*. John Macoun has recorded what was probably nearly the original distribution of this tree in Canada.¹¹ Outside of a few trees growing in Toronto he did not meet with it again to the west until beyond Lake Superior in the northern parts of the prairie provinces. Now the samaras or winged seeds of this maple hang to the tree all winter, and whenever obtainable constitute the principal food of the Evening Grosbeak. Indeed, when the seeds finally drop off, the birds descend to the ground and rarely leave the locality until the supply is exhausted. In the early days, with so large an area of country barren of their favorite food, it is not surprising that the birds only strayed over it in exceptional winters under pressure of food failure elsewhere. Today, however, the distribution of this maple is radically different. It is a hardy, quick-growing shade tree, and in consequence has been planted extensively,

not only about many farm houses, but in all the villages, towns and cities that have sprung up to the east and north of the Great Lakes. Thus a baited pathway has been laid from the usual summer home of the Evening Grosbeak right to our doors, and undoubtedly the bird has taken advantage of this fact to travel our way more often than it did before. It may even be prophesied that with the further increase of the Manitoba maple northward, the Evening Grosbeak will find sufficient food nearer its summer home and again become scarcer in our neighbourhood; for it was the extension of cultivation in similar localities that seems to have brought about a like change in the movements of the other birds that I have mentioned.

The Western Evening Grosbeak, *Hesperiphona vespertina montana*, was separated from the eastern bird on account of some slight colour differences and a relatively greater length of bill. For a long time our British Columbian Grosbeaks were, as a matter of course, referred to the western race. It has been evident for some time, however, that while they may be different from the eastern birds, they are certainly not the *montana* as originally disposed, with which they agree neither in colour details nor in the shape of the bill. Jos. Grinnell, the first to try to unravel the subject,¹² subdivided the birds previously grouped under the head of *montana* into three races, *montana*, *californica* and *brooksi*, and referred the British Columbian and the Washington birds to the last named subspecies. He based his distinctions on variations in colour and bill form. Now one trouble in estimating the values of these different characters is the difficulty of obtaining comparable material. All our specimens of true eastern *vespertina* are in winter plumage, while the majority of British Columbian specimens are in summer condition. Allowing for this, however, an examination of the few winter western birds available seems to indicate that while the width of yellow on the forehead and the back coloration of the male in the *brooksi* can be readily matched in specimens of the eastern bird, the dark-

¹¹ Macoun. Cat. Canadian Plants, Pt. I, Polypetalae, 1883.

¹² Grinnell, Condor, xix, 1917, pp. 17-22.

coloured head of the female *brooksi* does really enable us to separate the two races with some confidence. The bill averages a little slenderer in *brooksi* than in eastern specimens, but this is not a reliable guide, for the difference is so slight that it is hardly recognizable even in the figures that accompany Grinnell's description, and at times is quite swamped by individual variation.

I have been fortunate in having submitted to me for examination the two birds that were taken by Rowan at Indian Bay. One is an adult female in rather worn and faded breeding plumage, the other her fully fledged young still suffused on back and breast with the ochraceous buff that is lost in the post-juvenile moult before the first winter. There can be no question that the latter is a bird of the year, and the fact that it was still being fed by its parent indicates that it was raised within a short distance of where it was taken. The parent that was captured is fortunately a female, and consequently of the sex needed for subspecific determination, but the disturbing fact is that it bears the colour marks of the western bird, *brooksi*, rather than those of the expected eastern *vespertina*. Its head, in contrast with its back, is decidedly dark, and the specimen generally, in spite of its slightly worn and faded condition, is identical with birds from the Okanagan Valley, B.C. It is true that the bill is large and stubby rather than attenuated, and that a large stubby bill is a postulated character of the eastern bird; but, as mentioned before, this, in the opinion of the writer at least, is too variable a character to be of much service in determining individual specimens. Of course, it does not seem reasonable that the British Columbian Evening Grosbeak, *brooksi*, breeds eastward to Lake Superior nor would I care to suggest such a conclusion except to negative its probability. We may prefer to regard this specimen simply as a variant of the eastern *vespertina*, or perhaps suspend judgment until further evidence is secured.

This unfortunate occurrence of abnormality in a unique specimen brings up the important subject of the determination of slightly characterized races when they are found far from their natural habitats.

Birds with their great mobility certainly can and do wander to the most astonishing localities, and it is not impossible for occasional specimens to appear far from the land of their origin and direct blood relatives. In such cases are we to identify entirely from the characters that the birds exhibit? If we do, we are bound to make a multitude of errors through mistaking individual for racial variations. On the other hand if we allow considerations of geography to influence our identifications we are just as certain often to twist the evidence to suit our geographical preconceptions.

There are good reasons for either course. If a race means anything it must be based on germinal characters and denote blood relationship between the individuals composing it. An albino Negro would not be a Caucasian, however close the superficial resemblance might be. The very fact that an isolated community of a species has developed certain common characteristics indicates the possibility, perhaps even suggests an innate tendency, of the species as a whole to vary in that special direction; it would surprise us less to find such a variation sporadically in individuals of other communities than one the possibility of which has not been demonstrated. In other words, we can expect to find, even in pure lines of descent, disturbing variants (sports, if you will) resembling established races more often than departures in novel directions.

These considerations are against identifying by character alone without considering geography as an indication of probable descent. However, to lay too great stress on geography is equally dangerous and misleading. For if we plot distribution on the determination of specimens we certainly must not make postulated distribution, the basis for such determination or we shall be reasoning in a vicious circle. All we can do in doubtful cases is to acknowledge our ignorance, and content ourselves with naming the species, leaving the determination of the subspecies open for further investigation or fuller data.

In this case of the Evening Grosbeak, then, although we may be firmly convinced that the Indian Bay breeding bird is of

eastern stock, it does not seem that we are warranted in calling it anything more definite than *Hesperiphona vespertina*, the

Evening Grosbeak, leaving its eastern or western affinities, *vespertina* or *brooksi*, open for future consideration.

THE LARGER FRESHWATER CRUSTACEA FROM CANADA AND ALASKA.

BY FRITS JOHANSEN.

(Continued from Vol. XXXV, page 30)

III.—B. TADPOLE-SHRIMPS.

This suborder (Notostraca) is distinguished from the Anostraca by having a broad and flat dorsal shield covering the body, and from the Conchostraca by having a depressed body, and the shield single and attached at the front, not double (as a clam-shell) and confluent with the body dorsally.

The "tadpole-shrimps" do not have the antennae developed to the extent of the fairy-shrimps and clam-shrimps except in their larval stages, but both pairs are diminutive dwarfed stubs, especially the second pair. The paired eyes are not stalked, but sessile and placed close together dorsally near the front edge of the carapace. The mouth parts are well developed, and behind them follow a great number of foliaceous body legs (similar to these of the fairy-shrimps), of which the last (11th) pair in the females form a peculiar flat and rounded pouch (like a watch-glass) containing the eggs. The first leg-pair is the longest and ends, with *Apus*, in three long filaments, used as sensitive organs by the adults and also as swimming-organs by the younger stages. Behind the carapace protrude a varying number (1 to 3 dozen) of abdominal segments (the tail), which end in a plate (telson) flanked by two long filaments (cercopods). The color of the adults is a brownish green,¹ the carapace and eyes being the darkest. These animals thus remind one forcibly of the marine "horse-shoe-crabs" (*Limulus*) and as in the latter there is much movement possible between the shield and the body, of great import-

ance to the animal when digging into the mud or turning around. The interior organs are similar to those of the fairy-shrimps though the heart is shorter and there is a large, paired shell-gland.

Locomotion is accomplished principally by the foliaceous legs similar to those of the fairy-shrimps, and also by twistings of the tail. The food consists of small freshwater invertebrates (Entomostraca, etc.), or dead animals (even of its own species) which it catches in the water or by tunnelling in the surface of the mud bottom, passing any captured prey along to the mouth parts by the aid of the foliaceous legs. The larvæ hatch in the spring as clumsy nauplii or metanauplii from the ripe (red) eggs deposited in the fall upon water-plants, etc.; they differ much less from the adults than the larvæ of the two other suborders (fairy-shrimps and clam-shrimps), having traces of the carapace and abdominal segments, and later short cercopods. On the other hand particularly the second pair of antennæ are far longer and more powerful than is the case with the adults, and function as the principal organs of locomotion. During the summer the larvæ grow on and gradually assume the shape and colour of the adult. In some of the species the females attain a length of several centimeters, while the males are somewhat smaller. The latter are generally far less numerous than are the females and often first make their appearance in the latter part of the summer; it is therefore probable that when this is the case the eggs the females carry in the beginning of the summer are produced parthenogenetically, though it must

¹ That of the larva first orange, later yellowish.

be remembered that the eggs ² are carried a much longer time by the mother animals and develop more slowly than with the fairy-shrimps. Judging from the arctic form (*Lepidurus arcticus*) both sexes apparently live more than one year and probably hibernate in sufficiently deep ponds or lakes, supposing, of course, that they do not freeze into the ice, are not killed by the drying-up of the pond, or that their life-cycle is not completed. The larvæ apparently are too few and frail to keep the numbers up alone from year to year; this, coupled with the comparatively (i.e. compared with the fairy-shrimps) slow growth of the young individuals and the large size they have to attain, makes a normal age of several years a necessity, at least for the females.

While, so far as we know, the arctic form occurs year after year, the same is not the case with the more southern species. In some years the latter are entirely absent, or only females occur, and in this respect they are not unlike the "clam-shrimps". To a still larger extent than is the case with the "fairy-shrimps" the "tadpole-shrimps" and "clam-shrimps" are very erratic in their occurrence, especially outside the arctic; smaller ponds and pools may be teeming with them, while they are not found in others, nor in lakes close by; again they may be plentiful only at a certain time of the year.

Of the tadpole-shrimps only two genera are known, both occurring in the new as well as in the old world. They are easily separated by the spatulate or triangular outgrowth from the telson present in the one (*Lepidurus*), but absent in the other genus (*Apus*).

To *Lepidurus* belong about half a dozen species, to *Apus* about a dozen, of which four of each genus have so far been recorded from this continent. It is interesting that no Apodida have so far been found east of a line from King William Land south to Manitoba and the middle States, though the Arctic species is apparently circumpolar and has been recorded from Labrador and Greenland.

Of the four species of *Lepidurus* two have so far only been recorded from Colo-

rado and California and are likely to occur neither in Canada nor Alaska. A third species (*L. couesii*) was originally described by Packard from Utah and Montana and has since been collected in three of the western provinces of Canada (Manitoba, Saskatchewan and Alberta); it probably occurs also in British Columbia. Its carapace is large, so that only five "tail" segments and the spatulate telson are uncovered. Packard's specimens (both sexes) from Montana were taken in the first week of July, 1874, and had an average length of about 2cm. (exclusive of the cercopod-stylets). The Alberta specimen (see below) is nearly of the same size (it was dried up when I found it) as a specimen (female) about 3 cm. long from Dufton, Sask., now in the Royal Ontario Museum, Toronto; the latter was collected by a university student on June 20, 1913.

Prof. O'Donoghue, of the University of Manitoba, writes me (June, 1920) that he has recently collected this species (*L. couesii*) near Winnipeg, where it "is extremely common in the ditches on the west side of the south end of Lake Winnipeg". He has promised to send me specimens of it.

From Prof. A. G. Huntsman, of Toronto, I have recently received a number of specimens of the same species from one to two cm. in length. He collected them on June 11, 1920 in sloughs three miles north-east of Medicine Hat, Alta., where they occurred together with the fairy-shrimp *Streptocephalus coloradensis* (see page 29), and clam-shrimps (see later).

We have in the museum here in Ottawa a specimen of the same species apparently collected by J. B. Tyrrell in southern Alberta or British Columbia in the eighties. I found it among a number of other invertebrates from land and freshwater collected by Tyrrell at that time, but there was no date with it, and Mr. Tyrrell was not able to recollect the locality or date when I sent him the specimen. Beyond what is given here nothing is known as to the northern limit for this species; apparently, however, it is not found in the Yukon and the Northwest Territories, nor in Alaska, though it may occur in the most southern part of the last-named territory.

² At least the "winter-eggs."

As to its life-history (development), the stages between the eggs and the adults are unknown.

The fourth *Lepidurus* species is the well-known, eireunpolar form (*L. arcticus* Pallas) (*L. glacialis* Kroyer), first well described from West Greenland. It is immediately recognized by the fact that the telson ends in a triangular (not spatulate) plate obtusely pointed and with spiny edges. Its distribution is very similar to that of *Branchinecta paludosa*, having been recorded from Greenland³, Iceland, Spitsbergen, Northern Scandinavia, Novaja Semlja, Siberia and on this continent from Alaska to Baffin Bay. Its southern limit is not definitely established, but indicated by the following records in North America, Pribilof Islands, Teller, Point Barrow and Martin Point, Alaska; south side of Dolphin and Union Strait, King William Land and Labrador. Several of these records are based upon my own collections made on the Canadian Arctic Expedition, and the species will be treated in detail in the reports (Vol. VII, Part G) of that expedition. I have also given a detailed account of its biology and development as I studied it in Northeast Greenland (*Meddel. om Groenland*, Vol. 45, p. 333-37). Its structure, etc., has been well described and beautifully illustrated by Sars (1896) p. 68-82, Tab. 11-13. Its life-history is now fairly well known. The hibernating eggs hatch in June, and the nauplius, which is not unlike that of *Branchinecta*, soon assumes the metanauplius stage (see above). It is rather sluggish and seems to venture forth over the mud-bottom only when it has grown considerably and assumed the adult's color; even then it often takes refuge under the larger individuals. I secured the metanauplii in Greenland in June, but the youngest individuals I found during the Canadian Arctic Expedition (taken on July 3, 1916, at Bernard Harbour, N. W. T.), were 3 mm. long, and practically like the adults. Both in Greenland and in the Canadian Arctic I first

secured the few males in August, though adult females together with younger ones were secured from the end of July on; the latter first had ripe eggs in their brood-pouch in August. The last *Lepidurus* in the year were secured on October 6, 1915, together with the new Branchipod mentioned p. 29 (*Artemiopsis stefanssoni*). Even in the autumn and fall the animals range in size from about $\frac{1}{2}$ cm. to 2 cm., thus proving that they represent both that and the preceding years' brood (generation).

All the *Apus* species occurring on this continent have so far been recorded only from the middle and western parts of United States, and none from Canada or Alaska. One of them (*A. longicaudatus*) has, however, been recorded from Yellowstone River, so it is possible it ranges across the boundary into Alberta. Of the species occurring in Europe, some are interesting because they have been known for a much longer time than the American representatives. The genus was first described in the first half of the 18th century, and was subsequently listed by Linnaeus under the name of *Monoculus*. The genus *Lepidurus* was not separated out until more than half a century later, by Schaeffer.

A parasitic Trematode (*Distomum apodis* Pack.) has been observed in the egg-sacks of the genus *Apus* in North America (see A. S. Packard, in *Amer. Naturalist*, Vol. XVI, 1882, p. 142).

G. O. Sars in "*Crustacea*" (2d. Norwegian Arctic Expedition 1898-1902 ("Fram"), 1911, p. 15) records *Lepidurus apus* (Lin.), from a freshwater-swamp at Cape Rutherford, east side of Grinnell Land (about lat. 79° N., long. 75° W.), on August 29, 1898.⁴ This is the first time this species has been found in the arctic regions, and in America. It is, I believe, the same species as *L. (Apus) productus* Bose., known from a number of places in Europe.

(To be continued).

³ West coast up to Foulkefjord and Northumberland Island, east coast at least to 77° N.

⁴ *Lepidurus arcticus* was also secured by this expedition at Cape Rutherford.

ASSOCIATION, COMMENSALISM AND PARASITISM AMONG MARINE ANIMALS IN THE STRAIT OF GEORGIA.

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The conditions affecting marine life are sufficiently diversified in the waters of the strait of Georgia to supply material for investigation in every branch of zoology but no branch is better served than ecology.

In making ecological observations one is necessarily struck with the numerous instances of association, commensalism and parasitism, states which differ only in degree and between which complete intergrading is evident. The association may be quite casual as in cases where two or more species are found in proximity on account of the fact that they live on the same kind of food. The relationship is much closer in other cases where the species remain permanently in proximity, in some instances as much for mutual protection as for common feeding. It is but a short step from this to commensalism where two species (seldom more) bear such an intimate relation to each other that one is seldom found or never found without the other. They may be mutually helpful, and, if not evidently so, at least one must not be harmful to the other. The condition of one species feeding with another differs comparatively little from that of one species feeding on another, and so parasitism appears, going from the one extreme where the parasite is free to attack its host, to move about from one host to another or even to live apart from the host, to the other extreme where the parasite in the adult state has lost all power of locomotion and is otherwise so degenerate that it lives only by absorbing highly complex nourishment from the host.

The term "parasitism" is often loosely used in connection with such sessile forms as hydroids, bryozoa, etc., where there is no evidence of such. The larvæ of these forms, when they reach the end of the free-swimming period settle down, in most cases, on anything available for support throughout the rest of their life. In very

few instances is there any evidence that they receive any nourishment from the supporting object which consequently cannot be a host. It evidently cannot be a host when the support is a piece of rock or dead shell, and it is usually no more so if this is an animate object.

As an instance of more or less casual association the young herring and the stickleback will serve. The herring hatches out in March or April, and by July or August has taken on the real herring appearance. It gathers in schools to feed around wharves and floats and near the shore at various places, where it remains until it is about a year old. During this period the individuals mingle freely with the sticklebacks that are in that vicinity for the same reason, so that one seldom sees the one species without the other. Later the herring goes out to deeper water and the association is at an end.

Without going into detail other instances may be noted. The little blenny, *Anoplarchus*, is found with the cling fish, *Caularchus*, under stones that are left exposed at low tide, and with these the singing fish, *Porichthys*, often appears. Schools of sand launces are often associated with schools of herring. Viviparous perch, *Panerodon*, and sometimes *Teniotoca*, occur in the same locality as the rock cod, *Sebastes*. This is true of the two species of clams, *Saxidomus* and *Paphia*, and of the heart-urchin, *Schizaster*, the brittle-star, *Amphiura*, and the holothurian, *Molpadia*.

A somewhat closer association appears between two Chaetopterid annelids, a large one and a small one, and both of them with a Phoronopsis. They are all tubiculous species, living in the fine sand a short distance above lowest low-water mark. Where one is found the others are sure to be present. In certain localities, only exposed at the lowest tides, where coarse sand or fine gravel is mixed with mud, a *Synapta* is plentiful, and with it a brittle-

star, *Amphiura*, with long, slender rays. In appearance they have very little in common and yet they always seem to occur together.

The best as well as the most common and most extensive association is found almost everywhere in rough, rocky bottom at a depth of 25 or 30 fathoms in the open strait. The most conspicuous part of the association is made up of three sponges, *Bathydorus dawsoni*, *Rhadocalyptus dowlingsii* and *Aphrocallistes whiteavesianus*, the first two in particular being supplied with numerous siliceous spicules that make them troublesome to handle. With these are associated a spiny ascidian, *Tethyum igaboji* (the only very spiny ascidian to be found in the strait), a spiny brittle-star, *Ophiopholus* sp., and two species of the genus *Euphrosyne*, spiny annelids. These are all spiny creatures and hence they form a very well protected group. With these there may be other species of rarer occurrence; other species of annelids and sponges, and a brittle-star. Many species of bryozoa and hydroids are attached to the sponges but none of them seem to be essential to the association.

Examples of commensalism are numerous. The two species feeding together usually belong to different phyla and hence they are hard to group. It may suffice to arrange them according to the phyla to which the major members belong. The vertebrates do not supply instances. Apparently there is in this region no counterpart of the relation between the pilot-fish and the shark. Possibly the nearest approach to it is the case of the little sculpins that wait around for the crumbs that are dropped when the crab, *Cancer productus*, is having its meal of fresh barnacles.

The ascidians serve better, as with *Asciodiopsis paratropa* in particular, but also with *Phallusia ceratodes*, *Ciona intestinalis* and *Tethyum aurantium*, the hydroid, *Endocrypta huntsmani*, finds a close relationship, since it is found attached to the wall of the branchial cavity. A Pinnotherid has been found commensal with *Tethyum igaboji*.

Among the molluscs, the most familiar examples are found in the clams, *Mua* and *Schizotharus*, where various Pinnotherids or pea-crabs are much at home in the

mantle cavity. The condition here is extreme, for the body of the horse-clam in particular may be 16 or 18 inches down in the sand. The crab must therefore depend on the circulation in the clam for its oxygen as well as for its food supply. Another bivalve, the scallop or *Pecten*, may have either one of two species of sponges living commensal with it, the two species being *Esperella adhærens* and *Myxilla parasitica*. With a much smaller bivalve, *Axinopsis sericata*, occurs the hydroid, *Monobrachium parasitum*. The offensive zooids of *Monobrachium* extend over the ventral border of the valve and probably protect the mollusc as well as the hydroid colony. The key-hole limpet, almost invariably, has an annelid lying in the mantle cavity parallel to the foot, of a color that matches that of the foot and gills.

Among the crustacea there is what might be called a forced commensalism in the case of the decorating crab. Hydroids, sponges, bryozoa, etc., grow from many places on its exoskeleton, but the beginnings of the colonies are placed there by the crab itself. The hydroid, *Hydractinia aggregata*, is always found growing on a shell that is inhabited by a hermit crab, *Pagurus splendescens* (possibly other species as well). Here the arrangement is evidently mutually beneficial. The hydroid colony disguises the home of the crab and on the other hand it obtains food material let slip by its messmate. This is definitely indicated by the fact that the nutritive zooids are much more numerous near the margin of the shell, to the exclusion of the generative zooids that are always situated farther back. In some cases the hermit-crab, *Pagurus ochotensis*, (and possibly other species), has a closer association than that with the hydroid, when it has an annelid, *Nereis*, living with it within the shell.

No instance has appeared where an annelid is the major commensal except where both commensals are annelids. The Polynoid that lives in the tube of an *Amphitrite* is an example.

Among the Echinoderms one starfish, *Evasterias troschelii*, is seldom found without a commensal Polynoid, that matches the color particularly well but no better than the Polynoid found on the Holothu-

rian, *Stichopus*. Another Polynoid is commensal with the starfish, *Solaster stimpsoni*.

The jellyfish supply the only examples among the Cœlenterates. The largest jellyfish found along the coast, *Cyanea arctica*, has usually one or more species of amphipods and sometimes other crustaceans among its tresses. The actinian, *Bicidium æquorea*, is found attached to the umbrella-like surface of *Aequorea forskalea* and of *Thaumantias cellularia*. This actinian is spoken of as being parasitic but it is not probable that it is so. Finally, in the Porifera, the hermit crab, *Pagurus brandti*, appears surrounded by the living sponge, *Suberites latus*.

In taking up parasitism only ectoparasitism will be considered. The crustacea provide much the greater number of parasitic species. One vertebrate is probably parasitic. The lamprey, *Entosphenus tridentatus*, attaches itself to the salmon and uses it for transportation purposes, but it is scarcely possible that the skin of the salmon is so thoroughly pierced for this purpose alone.

One mollusc is apparently parasitic although it may be merely commensal. This is the species that has been called *Lepton rude* by Whiteaves and *Ericyna rugifera* by Carpenter, found attached to the surface of the abdomen of the sand shrimp, *Eupogebia pugettensis*. The annelid, *Myzostoma*, is parasitic on the Crinoid, *Florometra serratissima*. Trematodes are commonly

found in the gill cavity of several species of fishes, attached to the surface, and some blood-red nematodes have been found on the clingfish, *Caularchus meandrinus*.

The copepods make up a large portion of the list of parasitic crustacea. There is one parasitic isopod, *Phyllodorus abdominalis*, common on the abdominal surface of the sand shrimp, *Eupogebia pugettensis*, and a Rhizocephalan, *Sacculina*, on different species of shrimps.

Parasitic copepods were discussed in a paper read before the Royal Society of Canada in 1920. Those parasitic on fish are very numerous and of many species. In these there is the greatest variation in the manner in which parasitism has affected the parasite. *Galigus gurnardi*, for instance, shows no great degeneration and is almost as freely moving as non-parasitic forms. It moves readily about on the host and has been found with the plankton where it must have been swimming freely in the sea. From such a condition there is a gradually increasing degeneration until such a shapeless, helpless mass as that of *Chondracanthus* or *Clavella* is reached.

The only parasitic copepod found elsewhere than on fish, was a small, red species (undetermined) which is common on the red sand shrimp, *Calinassa californiensis*. It is quite possible that a more careful observation would bring others to light.

GLEANINGS FROM THE CANADIAN WEST. — PART I. AVIAN FAUNA OF ISLAY, ALBERTA.

BY J. DEWEY SOPER.

While accumulating the notes embodied in the following pages I felt congratulated in my fortune to be again haunting comparatively unknown fields in this delightful science. By unknown fields, of course, I refer to the geography in connection with the faunal forms that I mention, not to any original intimacy with the species themselves. The most, apparently, which a new region may do for one at this time, barring the extreme

and improbable fortune of discovering new members of our country's fauna, is to strengthen, correct, or establish lines of distribution. All the facts proffered may long since have been known to some one, perhaps even published in papers that I have as yet overlooked. Nevertheless I enjoyed a rare satisfaction in winnowing from the Islay prairies whatever of interest or value may appear in this article. Here, in this little, isolated

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western village, there existed such freedom of movement, such ready accessibility to the open and its occupants, that one seemed surrounded always by peculiar benefits.

Aside from the singular charm and seductiveness of the northern prairies in autumn, birds and mammals abound, making a visit there of very practical interest. I would not venture to describe the Islay region as inordinately rich in species, nor, on the other hand, markedly poor, remembering the latitude. In point of individuals, however, I will refrain, as I might be induced to expatiate too freely. I would say briefly in this connection, though, that it is my impression that one must visit a favorable place in our Canadian West fully to realize the great flights of waterfowl from the north which obtain during the autumnal migrations. Literally thousands upon thousands pass over a given locality in a single day, followed day in and day out at times, over areas of wonderful extent, with increasing or decreasing numbers. To be on hand therefore during these flights is a privilege to be cherished to the full.

I remained at or near Islay from August 29, 1919, until November 30 following, about fourteen weeks in all. My notes were collected under divers circumstances with no thought of publication at the time, and have since been pilfered from a rather promiscuous journal. Any lack of cohesion or consistency may possibly be traced to these circumstances.

Of the fifty species of birds recorded at Islay, a great many may be regarded solely as migrants, especially among the water-birds, although not all of these can be considered such. Before the advent of the settlers, most if not all of the waterfowl mentioned would, I believe, be found as breeding summer residents in the immediate vicinity. So many of the sloughs throughout the country have of late years dried up, that now numbers of these waterfowl are forced to other parts to rear their young. The majority of the smaller species will, in all probability, be found as summer residents. As concerns the general status of a region's bird life, an autumnal list certainly leaves

a great deal to be desired. Nevertheless there may be something of interest and value even in an incomplete list like the present.

AUTUMN BIRDS OF ISLAY AND VICINITY.

1. HORNED GREBE (*Colymbus auritus*). A few believed to be this species noted on Laurier and Whitney Lakes, Sept. 1.

2. HERRING GULL (*Larus argentatus*). The only individuals seen were two riding the waves near shore on Laurier Lake, September 1.

3. MALLARD (*Anas platyrhynchos*). Noted on various occasions throughout the season. What were suppositionally identified as mallards passed south near sundown on October 18, in a fast flying flock one hundred and fifty strong, strung out in a long single imposing line at right angles to the line of flight.

4. SHOVELLER DUCK (*Spatula cyanoptera*). Two individuals collected at Whitney Lake.

5. RUDDY DUCK (*Erismatura jamaicensis*). Observed on several occasions during September.

6. CANADA GOOSE (*Branta canadensis*). During migration very common. On the night of September 16, a large flock loudly "honking" passed over the town. Large companies bore southward all day September 18.

7. BLACK BRANT (*Branta nigricans*). I make this a hypothetical entry. On September 18 and 19, flocks named by an old gunner as brant passed southward calling regularly as they bore along. According to his statements their notes were easily distinguishable from others of their kin. The brant of any species, however, are supposedly rarely if ever to migrate inland. In Macoun's catalogue I find a note by Turner for the present species reading: "Few are seen in the fall as they then pass through the interior going south." I take it from this that their occurrence inland is not improbable.

8. AMERICAN BITTERN (*Botaurus lentiginosus*). One individual only observed on September 5, as it rose with a hoarse "squawk" from a mud-bar on the Vermilion river.

9. WHOOPING CRANE (*Grus americana*).

A solitary bird of large size, snowy whiteness, carmine coloring on the head and black primaries, was noted at 10 a.m., October 15. It was flying south-eastward at the rate of about twenty-five miles an hour.

10. SANDHILL CRANE (*Grus mexicana*). Flocks observed on September 18, 24, 25 and 27. The flock of September 25 was composed of 168 individuals.

11. WILSON SNIPE (*Gallinago delicata*). Several times observed during the month of September.

12. PECTORAL SANDPIPER (*Pisobia maculata*). One specimen collected in a grassy slough a few miles south of the Saskatchewan.

13. BAIRD'S SANDPIPER (*Pisobia bairdi*). A specimen of this interesting little arctic sandpiper was collected in a grassy slough margin near "the Ridge" on September 1.

14. LESSER YELLOW-LEGS (*Totanus flavipes*). Large flocks observed on various sloughs. One collected at Laurier Lake September 1. Very common on muddy slough margins in the vicinity of "The Ridge".

15. KILLDEER PLOVER (*Oxyechus vociferus*). Common during September.

16. RUFFED GROUSE (*Bonasa umbellus*). Common about Laurier, Whitney, and Raft Lakes. To my surprise several individuals were seen frequenting isolated "bluffs" of small aspens on the open range. These had wandered from the thicker continuous woods on the Vermilion river.

17. SHARP-TAILED GROUSE (*Pediacetes phasianellus*). Very common. During latter August and all of September, while the young were reaching their maturity, they were commonly found on the open prairie or grain fields. After the snow fall of October 7 and 8, which permanently remained, with thermometer in early November at 25-30 degrees below zero, the birds took up their winter quarters in good thick bluffs protected from cold winds by contiguous hills. These elevations, near their hibernal abodes, I am told, serve as their dancing grounds during the spring, summer and early fall.

18. TURKEY BUZZARD (*Cathartes aura*). The only note that I find in my journal referring to this species is under date of October 3, and reads: "A solitary buzzard sailed majestically towards the south this afternoon at a height of about 1000 feet. This is the only one of the species observed since arriving a Islay on August 27."

19. MARSH HAWK (*Circus hudsonicus*). Frequently observed during September.

20. AMERICAN GOSHAWK (*Astur atricapillus*). A large gray hawk flying over an area of snow-covered grain stooks on November 12, was identified as of this species.

21. SWAINSON'S HAWK (*Buteo swainsoni*). An adult specimen of this bird in dark plumage was collected on September 5. Previous to reading more carefully Mr. Taverner's *Birds of the Red Deer River, Alta.*, I felt assured that Swainson's Hawk was the only large hawk that I had been seeing. His fine series of skins however proved that differentiating "on the wing" between this and the Red-Tail is a doubtful proceeding. My journal reads throughout to the plenitude of Swainson's, some of which may have been *borealis*, despite the specimen collected on September 5, as a guide to the detection of the former.

22. PIGEON HAWK (*Falco columbarious*). Two individuals of this beautiful little hawk were noted during early September.

23. SPARROW HAWK (*Falco sparverius*). Not uncommon during September.

24. GREAT HORNED OWL (*Bubo virginianus*). Reported as a resident in the heavier woods along streams. During late fall both sub-species *pallascens* and *subarticus* would likely be found.

25. SNOWY OWL (*Nyctea nyctea*). An individual of this comparatively rare arctic bird was collected on October 10, following the snow-storm of the 7 and 8; when first seen it was sitting upright on a snow-covered stook, and with difficulty could it be determined whether it was really a bird or a turret of snow fashioned by the wind. It was rather wary when approached, but flew only short distances after taking to wing.

26. FLICKER (*Colaptes auratus*) A common species during September.

27. KINGBIRD (*Tyrannus tyrannus*). But one individual noted, and that on August 30.

28. HORNED LARK (*Otocoris leucolaema*)? My journal of September 13, reads: "Several times lately flocks of small birds have passed over-head, emitting soft twittering call notes identical with those of the eastern horned lark. I am convinced that these flocks are referable to the western variety of this species.

29. BLUE JAY (*Cyanocitta cristata*). One example noted in the Vermilion Valley about September 15.

30. AMERICAN CROW (*Corvus brachyrhynchos*). Quite common, large migrating companies passed south over the Twin Hills on September 30, October 1, 2 and 3.

31. RUSTY BLACKBIRD (*Euphagus carolinus*). Noted occasionally in early September, but large flocks were common from the 15th to the 18th of the month. Probably accompanied by a percentage of Brewers.

32. WESTERN MEADOW LARK (*Sturnella neglecta*). A very common bird of the prairies; still common on October 5, two days before the big snow storm. They then disappeared entirely.

33. WHITE-WINGED CROSSBILL (*Loxia leucoptera*). While tramping in a snow-storm on November 4 near a fringe of aspens skirting an alluvial lowland in the Vermilion valley, a solitary bird of this species came flying down the wind with the storm and lit in some aspens near by. I just managed to identify it in the driving snow when it was up and gone again.

34. REDPOLL (*Acanthis linaria*). On October 19 the first redpolls of the season were seen in a small flock erratically flying about the railway grade where quantities of seed bearing weeds had attracted their attention.

35. AMERICAN GOLDFINCH (*Astragalinus tristis*). Observed occasionally until the middle of September.

36. SNOW BUNTING (*Plectrophenax nivalis*). Commonly observed after October 15.

37. SMITH LONGSPUR (*Calcarius pictus*). While enjoying a ramble west of the town on September 27, a solitary individual of this species fluttered from the trail like a vesper sparrow, and alighted further along for concealment in an overhanging bunch of prairie grass. It permitted me again and again to approach very closely; each time it would flit along close to the ground, seek secret cover, and play the game again.

38. VESPER SPARROW (*Poecetes gramineus*). Very common during September.

39. SAVANNA SPARROW (*Passerculus s. alaudinus*). A single specimen collected on September 19.

40. SAVANNA TREE SPARROW (*Spizella monticola*). Noted frequently after September 14 and up to November 1.

41. SLATE-COLORED JUNCO (*Junco hyemalis*). First noted about the middle of September; common thereafter all fall, and still remaining in small flocks about the town in sheltered nooks on November 15.

42. SONG SPARROW (*Melospiza melodia*). Observed in migrating flocks of mixed species about the willow margins of dried-up sloughs during early September.

43. NORTHERN SHRIKE (*Lanius borealis*). Two individuals observed in early November.

44. SOLITARY VIREO (*Lanius solitarius*). A single individual was noted in a small aspen bluff on the prairie on the morning of October 1.

45. MYRTLE WARBLER (*Dendroica coronata*). Migrating in considerable numbers at Laurier Lake on September 1. The flocks were scattered about the low willow fringe, hedged in by the spruces on the east coast.

46. AMERICAN REDSTART (*Setophaga ruticilla*). A great movement among the warblers was one of the most conspicuous and interesting occurrences at Laurier and Whitney Lakes on September 1. This beautiful warbler in company with the former species seemed fairly to teem about the bushes.

47. AMERICAN PIPIT (*Anthus rubescens*). The first individuals of this species were noted on September 18. Not

being positive about the identity I was on the prairie the following morning at 5 a.m. to collect a cabinet specimen to make sure, and was surprised that no birds were to be seen. Their absence however was only apparent, for by 6 a.m. a few scattered individuals were in evidence and in the course of the next half hour, as the sun rose higher, flocks of hundreds appeared from the stubble. Individually they are not shy, but as a company they are very restless, rising erratically to wheel and dash in reckless abandon without apparent cause. A source of some surprise to me (with a ground-loving species) was their habit in one instance of alighting on telegraph wires which intersected the prairie.

48. BLACK-CAPPED CHICKADEE (*Parus atricapillus*). More common about the mixed woods in the vicinity of the lakes, but frequently seen in low willow-grown depressions on the prairie, far from large trees. Very common at Laurier Lake and Whitney Lake on September 1, in company with the warblers.

Others noted in the vicinity of Island Lake.

49. OLIVE-BACKED THRUSH (*Hylocichla ustulata*). A specimen was collected September 1 at Laurier Lake. It was exceedingly wary, and considerable manoeuvring was necessary before the bird was obtained. It was vigilantly feeding about the tangled growth on the margin of the lake shore.

50. AMERICAN ROBIN (*Planesticus migratorius*). Very common throughout the fall. The last record was a solitary bird feeding in the snow near Pleasant Valley on October 10, two days after the big storm. No record since.

51. MOUNTAIN BLUEBIRD (*Sialia currucoides*). Rather uncommon; scattered individuals in widely separated localities noted during September. My last entry is on October 5, "Three mountain bluebirds observed near evening along the trail east of the Twin Hills."

(To be continued.)

CORRESPONDENCE.

Bird Migration.—Replying to Prof. A. B. Klugh's note in the September, 1920, number of the *Canadian Field-Naturalist* I wish to point out that I made no dogmatic statement regarding self-consciousness in animals. What I did say was that I thought there was no such thing, which is very different from positively asserting the fact.

What I meant and intended to convey by pure nature was life carrying on its functions untrammelled by man's influence or interference, when elaborate schemes are seen to work out with the utmost precision, the lepidopteron in the one case, and the bird in the other, making no preliminary experiments, and hence no mistakes, but carrying out through their subconscious minds those changes and acts which are necessary for the propagation and continuance of their respective races, which changes and acts are surely of the Infinite. Very little onus I imagine rests upon me to prove that millions of birds as well as other animals are every year

making no mistakes in these matters. Of course it goes without saying that many lose their lives in carrying out these subconscious promptings. In the case of the bird, after having started on its journey it may be overtaken by a violent storm whilst crossing some large sheet of water and lose its life, but surely this and similar instances cannot be put down to the mistakes of the said creatures.

If, as Prof. Klugh says, there is absolutely no proof that any mind can communicate with any other mind save through the medium of the senses of hearing, sight, touch or smell, so likewise there is absolutely no proof that any mind cannot communicate with any other mind save through the above mediums. I personally much prefer to keep an open mind on the subject, believing that it may be possible for any one mind to communicate with any other mind irrespective of the aforementioned mediums.

I also do not see that it is so very hard to account for the fact that birds will

sometimes (not always by any means, for I have seen homing pigeons come home in one) become lost in a fog when migrating on the telaesthesia principle. Fog has a very depressing influence both physically and mentally, and why should it not therefore have the same effect upon subconscious perceptions, dulling and putting them out of commission for the time being, just as an electric storm affects the working of telephone, telegraph and wireless systems. In like manner I imagine the glare from a lighthouse on a dark night attracts the physical eye of the bird, drawing it out of its course and for the moment disrupting the psychological connection, which cannot be regained until normal conditions are re-established and the bewildered bird escapes from the light without losing its life, which so many do, thereby never reaching the land of which they had such a clear vision just before the physical faculty led to a disruption of the psychological connection, the same as the fog does or may do in the afore-mentioned case.

Speaking of bringing out latent faculties in animals, I once trained a British Goldfinch (*Carduelis carduelis britannica*) to perform some wonderful tricks, but no one will ever convince me that I was bringing out latent faculties already possessed by that bird. Rather would I suggest that dominant will power, as well as mesmeric influence, compelled that bird to perform acts which pure nature never intended it should, just in the same way as the lion tamer compels those noble animals to go through humiliating acts, which again pure nature never intended they should. Had they but self-conscious reasoning minds and knew their power I am afraid their tamer would soon be no more. It seems too sweeping a statement to say that no entirely new type of mental process such as reason can possibly be evolved by association with man, and I am still of the opinion that some of the higher animals from long association with man have, through his mental emanations, acquired some slight reasoning powers. It has been said that in such cases it is possible that the discarnate spirit of the animal does not return to the group-soul, but remains individualized.

To those who still hold to the theory that birds are possessed of reasoning powers I would suggest their reading Mr. C. W. Leister's experience with a Spotted Sandpiper, *Bird-Lore*, Vol. xxi, 1919, no. 5, pp. 287-289, wherein it is recorded how a Spotted Sandpiper (*Actitis macularia*), after her nest and eggs had been covered over, firstly with a cap, secondly with a leaf, thirdly with small sticks, and lastly with a stone, in every instance sat down on the top of the obstacle, and commenced incubating, surely a very foolish thing for a self-conscious and reasoning bird to do. In this instance I would suggest that subconscious mind brought her back time after time to the exact spot where the nest and eggs were, but that lack of self-conscious or reasoning mind allowed her to sit on the obstacles without ever investigating or removing them, which was perfectly feasible in cases two and three, and even in the first was not impossible. However, *chacun a son goût*, which also applies to the answers to the following questions, which appear to me to require more than the hearing, sight, touch or smell theory to explain them, viz:—

1.—How is it that a string of swallows gathered on a telegraph wire are able to leave it at one and the same instant?

2.—How do a flock of shorebirds manage to turn and twist at one and the same moment, thereby avoiding collision with one another?

3.—How do a pair of birds manage to work in harmony whilst constructing a nest?

4.—How does a bird when flushed from its nest on the darkest night yet find its way back?

5.—How does the larva, devoid of physical sight, yet manage to find its way from the food plant to the necessary pupating station, which may be hundreds of yards from the former?

I would suggest that telepathy (mind blending) answers Nos. 1, 2 and 3 in a nutshell, and likewise telaesthesia (the power of vision passing the limits of time and space) the two last. That I am not alone in discarding the sight or landmarks theory seems evident from an article in the October, 1920, number of the *Ibis*, which article was briefly reviewed in the January,

1921, number of the *Auk*, p. 147, the reviewer there stating that he heartily agreed with the views of the author, i.e. that birds do not rely to any large extent on landmarks to guide them on migration. However, we are all at liberty to hold our own views on these very interesting, but intricate, matters and having now clearly

stated mine, it is not my intention to pursue the subject further, seeing that it is given to none of us to prove absolutely what we may personally believe to be the answers to them all. The solution, like that to the life hereafter, it is not permitted us to see.

H. MOUSLEY, Hatley, Que..

PROSECUTIONS.

MIGRATORY BIRDS CONVENTION ACT AND NORTH-WEST GAME ACT BY OFFICERS OF THE DOMINION PARKS BRANCH AND ROYAL CANADIAN MOUNTED POLICE.

Migratory Birds Convention Act. Feb-1921 and May 19, 1921.

Percy McGray, Clarke's Harbour, N. S., killing a Murre. Specimen and gun forfeited. Fine \$10.00 and costs.

C. Harmston, Courtenay, B.C., shooting Sea Gull. Gun and Gull forfeited. Fine \$10.00 and costs.

Maurice Smith, Clarke's Harbour, N. S., possession of Eider Ducks. Dismissed.

Wm. Chapman, Jr., Dartmouth, N.S., shooting at a Murre. Fine \$10.00 and costs.

Leonie Allen, Petit de Grat, N.S., shooting Merganser in close season. Fine \$10.00 and costs.

Loehart Lohnes, Garden Lotis, N.S., killing a Duck in close season. Fine \$25.00 and costs.

Harper Allen, West Bathurst, N. B., Selling Geese. Fine \$3.00. Suspended.

Peter Pineau, Rustico, P.E.I., killing a Goose between the hours of sunset and sunrise. Fine \$10.00 and costs.

Stephen Heisler, Martin's River, N.S., killing a Duck in close season. Fine \$10.00 and costs.

Stanfords, Ltd., 128 Mansfield St., Montreal, P.Q.; Henry Gatehouse and Son, Bonsecours Market, Montreal, P.Q.; P. Poulin and Co., Bonsecours Market, Montreal, P.Q.; Walter Deery and Co., Bonsecours Market, Montreal, P.Q.; J. P. O'Connor, St. Antoine Market, Montreal, P.Q.; possession of Migratory Game Birds. Withdrawn.

Percival Allmond, Hamilton, Ont.,

shooting a Robin. Fine \$10.00 and costs. Juvenile, Britannia, Ont., molesting Canada Goose in close season. Suspended sentence and costs.

Robert Readman, Fort Francis, Ont. engaged in business of taxidermist without securing a license. Fine \$10.00 and costs.

John Jackson, Murray Harbour, P.E. I., shooting Canada Goose in close season. Fine \$10.00 and costs.

Sylvere Gallant, St. John's Road, Mud-dy Creek, P.E.I., Possession of a Duck in close season. Fine \$10.00 and costs.

Lloyd Heisler, Indian Point, Lunenburg Co., N. S., Shooting Ducks in close season. Fine \$10.00 and costs.

W. O. Bowser, Amherst, N.S., Molesting Ducks in close season. Fine \$25.00 and costs.

Artemus Davidson, Tindal Road, Amherst, N.S., molesting Ducks in close season. Fine \$50.00 and costs.

Enzor Oulton, Tormentine, N.B., killing or molesting Wild Geese in close season. "Goose-boat" seized and forfeited. Dismissed.

The Game Conservation Board of British Columbia has furnished the Dominion Parks Branch with a summary of prosecutions, from January 1, 1921, to May 9, 1921, under the British Columbia Game Act, which amount to violations of the Migratory Birds Convention Act:—

J. Antipas, Hunting Ducks in close season. Fine \$10.00

H. Crawford, Hunting Ducks in close season. Fine \$10.00

T. Leathem, Hunting Ducks in close season. Fine \$10.00.

Shing Chong, Mallard Ducks in shop for sale. Fine \$10.00.

Sam Lee, Mallard Ducks in shop for sale, Fine \$10.00.

G. A. Sharp, Mallard Ducks in shop for sale. Fine \$10.00.

Wong Wee, Did buy a Mallard Duck. Fine \$10.00.

Northwest Game Act Prosecutions.

A. Adams, Little Buffalo River, N. W. T. Trapping without a license. Two mink skins seized. Fine \$5.00.

NOTES AND OBSERVATIONS.

NOTES AND OBSERVATIONS ON THE WHITE-WINGED CROSSBILL.

— In many ways the past winter was a remarkable season. Snow covered the ground on the 13th of November, and although we had exceptionally mild weather with intermittent rains and no prolonged snow-falls, yet the temperature was consistently even and sufficiently low to keep the ground snow-covered until early March. On the 13th of March the fields about Montreal were practically bare and I was a little doubtful about undertaking a previously arranged snowshoe tramp with my friend, Mr. W. J. Brown. However, armed with very large snowshoes and proportionately large 'boeufs', I ran the gauntlet of interrogative glances and was glad to reach the station and further company. Snowshoeing on bare ground is not a conventional sport. Reaching Ile Jesus, adjacent to Montreal Island, conditions were reversed and bare spots the exception; while throughout a large spruce forest, twenty-five miles farther north, the snow was between two and three feet in depth.

Earlier in the morning, at St. Lambert, I had seen a few Robins, Song Sparrows and Bluebirds; but here were no cheery greetings from spring arrivals, although I saw a Marsh Hawk and a Red-shouldered Hawk, and glimpsed a furtive sparrow in the spruce undergrowth that I failed to identify. On the other hand here was a probable part explanation of the dearth of birds about urban districts during the past winter. Black-capped Chickadees were fairly common — about twenty-five being noted in two flocks. During former winters I almost invariably saw this bird on all of my walks in the vicinity of Mont-

real. I always counted on seeing at least the Chickadee until the past Winter, when I seldom saw it and then in greatly reduced numbers. In these spruce woods (mainly Black Spruce and Tamarack) one Canada Jay was seen, an Arctic Three-toed Woodpecker and four or five Red-breasted Nuthatches, but the most noticeable birds were Pine Siskins and White-winged Crossbills.

The Siskins were well distributed in small groups and pairs (?) and many were heard singing. Probably twenty-five were noted.

The Crossbills were also distributed in small groups but their erratic movements made it difficult to determine their numbers. All those that were plainly seen were males. Several were heard singing from spruce tops and one gave a remarkable flight-song — just skimming the tops of the conifers on fluttering wings, while giving a series of trilled songs continued throughout a flight of about one hundred yards, when the singer pitched into a spruce tree. Following, I found it feeding in the tip of a Black Spruce with two other males.

One song, or flight-note, that was heard several times, recalled the tremulous twitter of the Snow Bunting so strongly that I was at first inclined thus to record it. On March 27th we revisited this locality, minus our snowshoes, but found still a good two feet of snow in most places and progress was laborious. Although two flocks of ten and twenty White-winged Crossbills were seen feeding on tamarack seeds, and other birds were heard in flight, we were un-

able to determine whether they had commenced nesting or not.

On April 3rd practically the same ground was covered and although one Crossbill was heard in flight, none were seen.

It is noteworthy that this species appears to be the prevalent crossbill in the Montreal district, at least during recent years; while in Compton County, during the years 1899-1902, and at other times, I did not record it at all, but found the Red Crossbill a common bird.

L. McI. TERRELL.

OBSERVATIONS ON THE BIRDS OF PRINCE EDWARD ISLAND.

During the month of June and the first few days of July, I was engaged in marine biological work at Malpeque, P.E.I. I was able incidentally to make a few observations on the birds of the region and these are worth putting on record only because very little has been published concerning the avifauna of Prince Edward Island.

The country round Malpeque Bay, which is also known as Richmond Bay, is practically all cleared. Here and there small patches of White Spruce and Paper Birch remain, and on the north side of nearly every house is a wind-break of these same trees left as a protection against the bitter north winds which sweep in from the Gulf of St. Lawrence. Curtain Island, near the middle of Malpeque Bay, and some of the other islands in the bay, are fairly well timbered.

The chief feature of the avifauna as a whole which impresses one is that it is not particularly rich in species, but that there are a great number of individuals of such species as do occur.

On the bay and on the outer coast the commonest birds are the Common Tern and the Herring Gull. On Fish Island, and on its great barrier dunes which extend practically across the mouth of the bay, the Piping Plover is very common, and its melodious yet somewhat plaintive note seemed to fit in most appropriately with the vast gray expanse of the dunes and the roar of the surf.

The Belted Kingfisher is not uncommon and a pair had their home in a

burrow in a high eroding cliff on Curtain Island.

The Ruby-throated Hummingbird is fairly common and a pair nested in the orchard beside the North Shore House at which we stayed.

Of the Woodpeckers the Flicker and the Yellow-bellied Sapsucker are the commonest species, the former being abundant and nesting in the old spruce stubs which in many places are found along the fences.

The Kingbird, the Olive-sided and the Least were the only Fly-catchers observed. About a quarter of a mile from the North Shore House there is a little patch of spruce, and from the top of one of the tallest of these trees an Olive-sided Flycatcher uttered his "Whip-whee-yoo-u-u" from morning till night, and this clear ringing note reached us with its volume but little diminished. He also had a softer "Quilp-quilp" which he used occasionally. A Least Fly-catcher, which nested in the grounds, was the most persistent singer of all the birds of the neighbourhood. His chief haunt was in one of the tall willows, and here he sat and uttered his "*Chebec-chebec-chebec-chebec-chebec-chebec*" so continuously that one wondered when he found time to eat. On two or three occasions I saw him describe an arc in the air, and while doing so he sang a song quite unlike, and far more melodious than, his usual monotonous vocal performance.

The Prairie Horned Lark is common in the fields. The Crow is abundant both in the fields and on the shore. The Bronzed Grackle is one of the most abundant birds of the whole region about the bay, and nearly every patch of spruce held a large colony of these birds. The status of this species on the Island seems to have changed since Macoun in 1888 wrote "One pair seen at Tracadie", and Dwight in the nineties said "A pair of these birds in Mr. Earle's possession were the only ones he had ever seen on Prince Edward Island."

The Purple Finch is a common summer resident, and a male which lived in the vicinity of the North Shore House was the most brilliant songster of this species I have ever heard, his rich warbling re-

frain being deep in tone and long-continued.

The Vesper Sparrow is extremely common, but is exceeded in numbers by the Savanna Sparrow which is the most abundant bird of the region. The White-throated Sparrow is common in such pieces of woodland as are left, this being particularly the case in a damp piece of forest near Kensington and in the woods on Curtain Island. The Song Sparrow is common, the Chipping Sparrow rather scarce, and the Slate-coloured Junco abundant.

Of the Swallows, the Tree Swallow is the most abundant species, though the Barn and the Cliff Swallows are common and many colonies of Bank Swallows nest in the soil at the top of the cliffs on Curtain Island and at other points along the coast.

The commonest species of Warblers are the Myrtle, Magnolia, Yellow and American Redstart. A pair of Myrtles lived in the wind-break in front of the North Shore House and the male was a continuous singer. A pair of Yellow Warblers had their nest in a gooseberry bush in the garden. It was composed of dried grass, pieces of twine and yarn, and bits of birch-bark, and lined with hair and a few chicken feathers. When the female was hunting material for her nest she frequented the lawn and readily accepted donations in the shape of yarn or twine. When she was seeking hairs with which to line the nest, she seemed to find the verandah the most promising hunting-ground, and finding a hair caught in a crevice, or on a splinter, she pulled at it, now from this direction, now from that, swinging round and round as she tugged, and usually succeeding in dislodging it. The male took no part in the construction of the nest, nor in incubation, but brought insects to the female while she was sitting. Three of the four eggs hatched and the shells and the unhatched egg were removed from the nest. For the first two days after the young appeared the female spent most of her time brooding, while the male was busy foraging. As he approached the nest he invariably sang, and when the female heard him she usually slipped from the nest and

went off to secure a few insects, sometimes for herself, sometimes to give to the nestlings on her return, while the male fed the nestlings. In the early days of feeding whole insects were not given to the young, but the insects were pounded and swallowed by the male, then regurgitated into the throats of the nestlings.

The Maryland Yellowthroat and the Canadian Warbler were seen only in the woods on Curtain Island.

The Chickadee and the Acadian Chickadee are about equally common in the pieces of woodland.

The Hermit Thrush and the Olive-backed Thrush were observed in the woods on Curtain Island and were heard singing from the woods on some of the other islands.

The Robin is abundant, and three pairs nested in the grounds on the North Shore House. The songs of the three males differed considerably in quality, and one of them had a most characteristic refrain in which the syllables "*Rip-rip-ter-rurr*" occurred very conspicuously and with great frequency.

A. BROOKER KLUGH.

PRAIRIE WARBLER AT HAMILTON, ONT.

On going into the garden on the morning of May 12, 1920, to look for migrating birds, I noticed an unfamiliar Wood Warbler feeding in a thicket of wild plum trees. I observed it carefully for several minutes at a distance of about twenty-five feet, with bright sunlight behind me, using 6 X field-glasses. As the bird was moving away, I was unable to get a good view of the head or under-parts, but could see that they were bright yellow marked with black. Observation of the upper-parts was very satisfactory, however, and I noted a reddish, saddle-shaped area on the back, which was olive-green. On consulting P. A. Taverner's "*Birds of Eastern Canada*", I identified the bird as a Prairie Warbler (*Dendroica discolor*). I knew that the bird was not a common one; but not until recent conversation with Messrs. W. E. Saunders and H. F. Lewis did I realize that it is rare enough to

make this record of possible interest to other observers.

The thicket in which this bird was seen runs through two gardens and some adjoining vacant-building-land on "The Mountain" and about three hundred yards south of its edge. The neighborhood is a very quiet one; and the thicket is a favorite haunt for migrating birds. Only the Yellow Warbler, of this family, was noticed there before the Prairie Warbler in 1920; and no others were recorded until several days later.

R. OWEN MERRIMAN.

BOHEMIAN WAXWINGS IN SASKATCHEWAN.

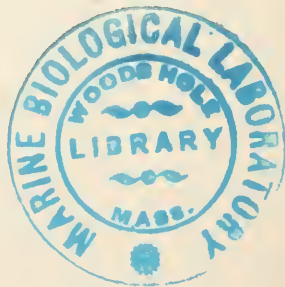
On April 1st (1921) I saw a very interesting and to me a new sight. When I say I saw a flock of one thousand Bohemian waxwings, I feel confident that I could multiply that number by three and still be within the mark. This was in River park (Regina). There were acres of them, feeding on the bushes and shrubs of the park. They would take wing, circle, and again alight, and as they rose there was a roaring sound from their wings. They flew from bush to bush and passed within ten feet of me

quite unafraid. I was surprised to see not a few of them with a white spot the size of a five cent piece at the side of the neck, just in front of the wing at the shoulder. It was a beautiful sight to see a tree literally covered with hundreds of these birds, the branches bending under their weight. I have not heard of their having been seen in such large flocks before.

NEIL GILMOUR, Moose Jaw, Sask.

APPOINTMENTS. — In November, 1920, Mr. Harrison F. Lewis, of Bergerville, Quebec, and Mr. J. A. Munro, of Okanagan Landing, B.C., were appointed Chief Federal Migratory Bird Officers for Ontario and Quebec, and for the Western Provinces, respectively, Mr. R. W. Tufts, of Wolfville, Nova Scotia, was appointed to a similar position for the Maritime Provinces in 1919. All three have brought to their new positions that prime requisite, a thorough knowledge of ornithology, and great advances in the cause of bird protection in Canada may confidently be expected as a result of their efforts.

H. L.





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A POPULAR DESCRIPTION OF DINOSAURS.

By C. M. STERNBERG.

INTRODUCTION. — Palaeontology deals with the history of life, and its time is measured in millions of years rather than centuries as civilization is measured. The time that civilized man has ruled the earth is to the time that life has been upon it, as a day is to the average life of a man.

In the remote past many orders of reptiles and other animals flourished during their time, then passed away, in many cases leaving no descendants. Were it not for the fact that many of these ancient animals left their bones entombed in the rock that was laid down at the time when they lived, we would know nothing about the animals that inhabited the earth in past geological ages.

Among the most interesting and remarkable of these animals were the dinosaurs which were so abundant during the Mesozoic Era.

GENERAL DISCUSSION.—The name Dinosaur is taken from the Greek and means Terrible Lizard. It was first proposed by Professor Owen, the eminent English palaeontologist and anatomist. The dinosaurs were an order of reptiles comprising the largest land animals of which we have any knowledge, and in most classifications of the animal kingdom hold the same rank as the *Chelonia* (tortoises and turtles) and *Squamata* (lizards, snakes, etc.). They were the dominant type of land animals during the Mesozoic period or Age of Reptiles, which lasted some millions of years and closed at least three million years ago. They were widely distributed, their bones having been found on each of the six continents, although North America has yielded by far the greatest number of genera and complete specimens.

The dinosaurs varied greatly in size, structure and habits, but all of them are noted for their small and primitive brain. While some of the amphibious forms, of Jurassic age, attained a length of one hundred feet, others were very small, *Compsognathus*, a carnivore of Jurassic age, being only two feet in length. The small carnivora were very slender and without doubt were fleet-footed and active. The armored forms were heavy-boned, clumsy, slow-moving creatures. Some forms must have taken to the water for defence, while others were provided with horns, and yet others were completely incased in dermal armor or plates of bone in the skin. They all possessed four limbs, though in some the front pair were very small. None of the dinosaurs had the power of flight so far as known, though a contemporary order of reptiles, the *Pterodactyles*, must have been as graceful flyers as our present-day bats. The amphibious forms (*Sauropoda*) must have spent much of their time in the water. Some students believe that they never left the water, though of course like all reptiles they were compelled to keep the nose above water to breathe. In this sub-order are placed *Gigantosaurus*, *Brontosaurus*, *Diplodocus*, etc.

Certain of the carnivorous forms were so bird-like that, where only part of the skeleton was known, they have been called birds. Because of the great similarity between these forms and certain birds, some students believe that in the course of evolution, the birds evolved through the dinosaurs, while others believe that both birds and dinosaurs were derived from a common ancestor. The similarity of certain dinosaurs to birds is most no-

ficeable in the pelvis, or bony arch with which the hind limbs articulate, and the hollowness of the bones, especially those of the limbs.

The largest of the carnivorous forms, which attained a length of forty feet, has been named *Tyrannosaurus* or Tyrant Lizard, and quite deserves the name *Dinosaur*.

People often say "What strange animals lived in prehistoric times", but they do not think of the strangeness of some of our present day animals because they are familiar with them. They remind one of the small boy who, when visiting the Zoo for the first time, gazed intently at the giraffe for a few moments, then turned to his mother and said, "There aint no such animal."

THE CANADIAN FIELD. — Our Canadian field, on the Red Deer River, Alberta, is probably the richest known for the collection of dinosaurian remains, if we consider the number of genera and species it has produced and the completeness of the specimens. Though we have made great advances in our knowledge of the upper Cretaceous dinosaurs, there are several species which, as yet, are represented by such fragmentary material that only insufficient knowledge of their structure can be gained.

There are two subdivisions of the upper Cretaceous, known as the Edmonton and Belly River formations respectively from which Geological Survey field parties have collected most of the dinosaurian remains now preserved in the Victoria Memorial Museum at Ottawa. The Edmonton formation is best exposed along the Red Deer river northeast of Calgary, Alberta, while the most productive deposits of Belly River age are exposed along the same river east of Calgary. These are rising several times. What is now two divisions are separated by about six hundred feet of marine deposit (Ft. Pierre), showing that at the close of the Belly River age this region was submerged beneath the sea and did not reappear until Edmonton time.

There is much evidence to show that during Cretaceous times the continent was not stable but sank in one area and rose in another, and repeated the sinking

Alberta was submerged beneath the Cretaceous sea no less than three times. The close of the Cretaceous period marked the draining off of the Cretaceous sea and the country continued to rise until it reached an altitude of thirty-five hundred feet above sea level. Subsequently most of the deposits which were of more recent age than Cretaceous were eroded away, and finally the great ice cap aided in the leveling by scouring here and filling there. Only a remnant of the more recent deposits is left on the high points which did not succumb to the levelling e. g. the Hand Hills and the Cypress Hills.

Since the glacial period the Red Deer river has cut a great trough in the prairie and has tapped the ancient burial ground. The erosion has been so rapid that the banks are quite steep, and the rocks are denuded of soil or vegetation and in many places are weathered into a badland topography of many canyons, ridges and steep slopes. In these badlands Geological Survey parties search out the ancient giants and remove them to Ottawa, there to be preserved for all to see and study.

At the time when the Belly River and Edmonton deposits were being laid down this section of country was a great low-lying land of many lakes, bayous and swamps, which were very little above the level of the Cretaceous sea. This sea extended from the Gulf of Mexico over what is now the prairie states and provinces and at one stage connected with the Arctic Ocean, thus separating the western part of the continent from the eastern part.

That the dinosaurs lived near sea level is proved by the fact that we often find mingled with their bones, the bones of marine animals which had wandered too far inland or whose bones had been driven in by the waves. Most of the deposits in which the remains are found are of fine grained sand and clay which indicates sluggish streams or quiet water.

Evidence points to a dense growth of both land and water plants. Rushes are very common, as are trunks, branches, and cones of the Red Wood. The presence of palms, figs, and other forms of

similar habitat indicates that the climate was semi-tropical.

This must have been a much favoured haunt of dinosaurs and other reptiles, for there are thousands of individuals represented and of course we see only a very small percentage of the bones that were entombed in the rocks.

As the animals died on the banks of a river or lake or on a delta, the flesh was torn off by some hungry carnivore and the bones scattered. In times of flood these bones were picked up and carried to some lake or washed upon a mud-flat or sand-bar. There are a great many extensive "bone beds" or layers in which thousands of bones have been deposited, as driftwood would be thrown up on a beach by the waves, or carried on to a mud-flat by back water. These bone beds are usually at the junction of the clay and sand rather than wholly within either type of deposit. The bones in these deposits are usually disarticulated and show signs of having been tossed about by the waves.

Besides these bone beds many skulls and skeletons were deposited more or less complete. Some of these seem to have been washed upon a beach or mud-flat and after the lower half was covered with sediment the exposed portion was torn away by some carnivore leaving only half of the skeleton to be preserved. In other cases the animals were mired or the carcasses were washed into quicksand or on to mud-flats where the carnivora could not reach them. One skeleton collected shows the remains of rushes which grew among the undisturbed bones and even the skin impression is preserved. It is very common to find skeletons mingled with the remains of vegetation such as rushes, moss, leaves and branches of trees. The animals which spent most of their time in the water are better known than those which habitually lived on land, because after death their bodies often floated into some lake or bayou beyond the reach of the carnivora and were buried intact.

KINDS OF CANADIAN DINOSAURS.—Of the dinosaurs that have left their bones entombed in the Belly River and Edmon-

ton formations along Red Deer river, Alberta, the best known are divided into four families. The most common is that of the duckbilled dinosaurs or *Hadrosauridae*. Of this family nine genera have been collected from Alberta, eight of which have not been found in other deposits. Next in number comes the family of horned dinosaurs or *Ceratopsia* of which two genera have been described from the Edmonton and five from the Belly River formations. None of these are known from any other age. The armored dinosaurs or *Ankylosauridae* are not as well known as the above-mentioned families. The carnivorous dinosaurs belong to a different sub-order. They do not possess a predentary (a bone situated in front of the dentary or lower jaw) as do the above-mentioned families. None of the very large or very small dinosaurs have been found in these deposits. They have been found only in older deposits than those represented on the Red Deer river.

The duck-billed dinosaurs were heavy-boned creatures which ranged up to forty feet in length. The legs were of unequal size, the hind pair being the larger. The fore-feet had four toes and the hind ones three. The terminal phalanges of the toes of the hind feet and part of those of the front feet bore hoofs. All four feet were webbed. The tail, which comprised about half the length of the animal, was high and narrow, making a powerful swimming organ. The integument was made up of small scales, (non-imbricating and polygonal) which were little thicker than the scales of a snake. At certain intervals there were areas of larger scales or raised bosses which varied in shape and arrangement in different species. It is probable that with this varied skin pattern there was a varied color pattern which may have been quite ornamental. The thin skin and absence of any means of defence, coupled with the webbed feet and swimming tail, seem to prove beyond a doubt that these dinosaurs spent most of their time in the water or at least took to the water for protection from their enemies. The premaxillae and predentaries were expanded and incased in a horny sheath similar

to the bill of a duck, hence the name "duck-billed".

These dinosaurs were purely herbivorous as shown by their teeth. The teeth were arranged in a magazine in vertical as well as horizontal rows. There were more than twelve hundred teeth in the four jaws but only about one in five of these was in use at a time, as there were five or more teeth in each vertical row. As the teeth became worn they were pushed out and replaced by new ones which were ever forming at the base of the magazine. In this respect they differ from the mammals which have only two sets of teeth. The cutting surface of the teeth was on the inside in the case of the upper jaw and on the outside in the lower jaw. The lower jaws passed within the upper jaws and the teeth worked like a pair of shears in cutting the soft vegetation after it had been nipped off with the expanded beak. The duck-billed dinosaurs ranged over much of North America during late Cretaceous times.

The horned dinosaurs were quadrupedal land animals with short massive limbs. There were five toes on each front foot and four functional and one vestigial toe on each hind foot. In general build of the limbs and feet they somewhat resembled the rhinoceros.

These animals had the largest heads of any land animal known. In the case of one (*Chasmosaurus belli* Lambe) the skull covered half the length from the snout to the drop of the tail, measuring five and one half feet. Triceratops skulls, (from a more recent formation) have been recorded up to nine feet in length. These huge skulls were solidly constructed and were surmounted by three horns one over each eye and one over the nose.

In some cases the nasal horn was greatly developed at the expense of the supra-orbital horns, while in other genera the reverse was true. The back of the skull was developed into a large crest or shield which extended over the neck and shoulders. This crest helped to give the skull its huge proportions and with the horns must have been a formidable means of defence. The snout was developed into a sharp cutting beak incased in a horny

sheath, similar to that of a parrot but many times as large. This beak was probably used for cutting off the vegetation on which the animal fed. The horned dinosaurs had the distinction of being the only reptiles which had double rooted teeth. The teeth were arranged in magazines somewhat similar to the teeth of the duck-billed dinosaurs, but fewer in number. They show that the animal was herbivorous in habit. The tail was shorter and more nearly round than in the before-mentioned family and shows no adaptations for life in the water. The skin of the horned dinosaurs was made up of non-imbricating polygonal scales which were larger and somewhat thicker than those of the duck-billed family. Some of the largest scales were two inches in diameter. The first horned dinosaur skin impression brought to light was that described by the late Mr. L. M. Lambe in the *Ottawa Naturalist* for January, 1914.

It is probable that these animals were gregarious in habit, as the writer has observed a number of deposits of bones in which only horned dinosaurs were represented and seemingly only one genus in each case. This would seem to indicate that they assembled in certain swampy or low-lying areas from which other animals were excluded.

Skulls of this family are much more common than skeletons. This may be explained by the fact that they lived and died out of the water, and as the skull, which was solidly constructed, was more durable than the rest of the skeleton, it may have lain on the banks for months before it was picked up by some flood which carried it for miles. Thus the skull would remain intact while the rest of the skeleton would be widely scattered. The reverse of this situation is true in the case of the water-inhabiting duck-billed creatures whose skulls were more fragile and seem to have been easily detached from the body and destroyed. In the Belly River formation it is common to find skeletons of the duck-billed dinosaurs without the head. This seems to prove that the neck was weak and allowed the head to drop off as the car-

case floated about before reaching its final resting-place.

The third family of herbivorous dinosaurs found in the deposits along the Red Deer river is the armored or plated dinosaurs. They were low, heavy-boned, quadrupedal, land animals with very short massive limbs. The feet were short and stubby and somewhat resembled the feet of a rhinoceros. The ribs were so constructed and articulated as to throw them well out and give a broad back and a large body cavity much the shape of a huge barrel. The hips were as much as five feet broad though the animal was not more than six feet high.

These dinosaurs were completely incased in dermal armor or bony scutes in the skin. In some genera the scutes were high-keeled, thick and as much as a foot and a half in length, while in other genera they were more plate-like with only slightly elevated keels. The larger scutes were arranged in rows along the back and sides while on the under parts were ossicles of irregular shape which protected the animal much as the chain armor protected the warrior of the middle ages. Between the large scutes were smaller ones and in the smaller intervening spaces were tiny ossicles similar to those on the under parts. It is quite evident that these creatures were so effectively armored that they need have no fear of their enemies. The tail terminated in a bony club, about the size of a water pail, which was made up of a number of modified dermal scutes thoroughly fused together. The eyes were protected by a bony lid, and in at least one genus (*Panoplosaurus*) even the mouth was protected by a plate of bone in the cheek, which Mr. Lambe has called the dental plate. The members of this family also possessed a horny beak. These animals were so well protected that they did not need speed as a means of escape and so became a heavy sluggish animal in which the main development was strength to carry the heavy load.

The armored dinosaurs had an exceptionally small brain, the cavity being smaller than a man's fist. The neural canal was greatly expanded within the sacrum, and Prof. Marsh thought that this was the seat of that part of the brain which controlled the action of the animal.

There are at least four genera of carnivorous dinosaurs represented in these rocks, the largest of which is *Gorgosaurus*. While *Gorgosaurus* attained a length of thirty feet there was a contemporaneous carnivore which was probably not more than eight or ten feet long. Only fragments of the latter have been found and it has not been described.

Gorgosaurus had a much lighter frame than the herbivorous forms and the limb bones were hollow. The bones show many well-developed areas for the attachment of muscles. No doubt *Gorgosaurus* was much more active than the herbivorous forms, but of course was too heavy to be agile. The smaller forms were probably much more active.

The carnivorous forms walked on their hind feet only, and used their huge tails as balancing organs. The front limbs were very small, specially in *Gorgosaurus*, and could have been of little use. This limb was becoming vestigial as shown by the study of earlier carnivorous dinosaurs. The fore-limb possessed only two functional digits and one metacarpal which was vestigial, while the hind foot had three well developed and powerful toes and a smaller one at the back similar to the back toe of a turkey. The fifth toe was represented by the proximal part of the metatarsal. The terminal phalanges each bore a powerful claw. *Gorgosaurus* had four powerful jaws in which were more than sixty sharp, double-edged, recurved teeth, some of which were four inches long. It must have been a fierce looking lizard as the name implies.

Mr. L. M. Lambe suggested that *Gorgosaurus* may have been a scavenger, since the teeth of the type specimen showed no sign of wear.

Another fairly well-known genus is *Ornithomimus* which was much smaller and of more slender construction than *Gorgosaurus*.

The carnivorous dinosaurs were not fitted for life in the water.

Extinction.—It is impossible to say what caused the extermination of the dinosaurs. Changing conditions with the cutting off of their food supply and their inability to migrate great distances may have been one cause. The rise of the mammals with their

more highly developed brain may have put the huge stupid dinosaurs to a disadvantage in the contest for subsistence. In the most recent formation from which dinosaurian remains have been collected, (the Lance formation) there are only a few genera represented, which seems to point to the gradual rather than sudden extermination of the order. Certain families of turtles, crocodiles and fishes which existed with the later dinosaurs have persisted to the present day with very little change. That the dinosaurs evolved very rapidly

is shown by the fact that with few exceptions a genus did not persist from one geological subdivision to another. For example in the Edmonton formation, which is separated from the Belly River formation by about six hundred feet of marine shales, we do not find the same genera that are found in the Belly River formation, though in several cases the line of descent is quite apparent. Geologically speaking these formations are quite close together in time.

A CYPRINID NEW TO SCIENCE.

BY PHILIP COX, PH.D., UNIVERSITY OF
NEW BRUNSWICK.

This minnow (*Leuciscus rubrilateralis* Cox) was discovered by the writer in the summer of 1897 while he was investigating the fresh-water fishes of the peninsula of Gaspé, P.Q. It was generally associated with *Conesius plumbeus* Agassiz, but in some of the rivers, i.e. Nouvelle and Grand Pabos, it was the dominant form. At that time the fish was diagnosed as the eastern representative of *C. dissimilis* Girard, or a variety of *C. plumbeus*; and, as the latter, was reported to the Royal Society of Canada (Fresh Water Fishes and Batrachia of the Peninsula of Gaspé and their Distribution in the Maritime Provinces of Canada, by Philip Cox, Ph.D., *Trans. Royal Soc. Can.*, Vol. V, Sect. IV, p. 148, 1899).

A subsequent and more critical study of the few specimens preserved seemed to confirm that view, and it was published as *C. p. rubrilateralis* Cox (Cyprinidae of Eastern Canada, *Bull. No. II., Proc. Nat. Hist. Ass., Miramichi*, 1901, p. 42).

In August, 1918, numerous specimens of this minnow were taken by the writer in Black Brook, Loggieville, Miramichi, N. B., and carefully diagnosed, when the two most important characters, namely, the dental formula and the presence or absence of the barbel were more satisfactorily

determined from the examination of a large quantity of fresh material. It was then seen that its affinities were with the genus *Leuciscus* rather than with *Conesius*, and that it was entitled to full specific rank.

The Gaspé fish are small, rarely exceeding four inches in length, but, like all the cyprinids of the peninsula, are brilliantly colored, the males well deserving the name "redfish", by which this species is known locally in Loggieville. The Miramichi Redfish are much larger, often attaining a length of six inches, but the coloration is dull, except in the breeding season, when the rosy hues are intense on the males but only perceptible on the females.

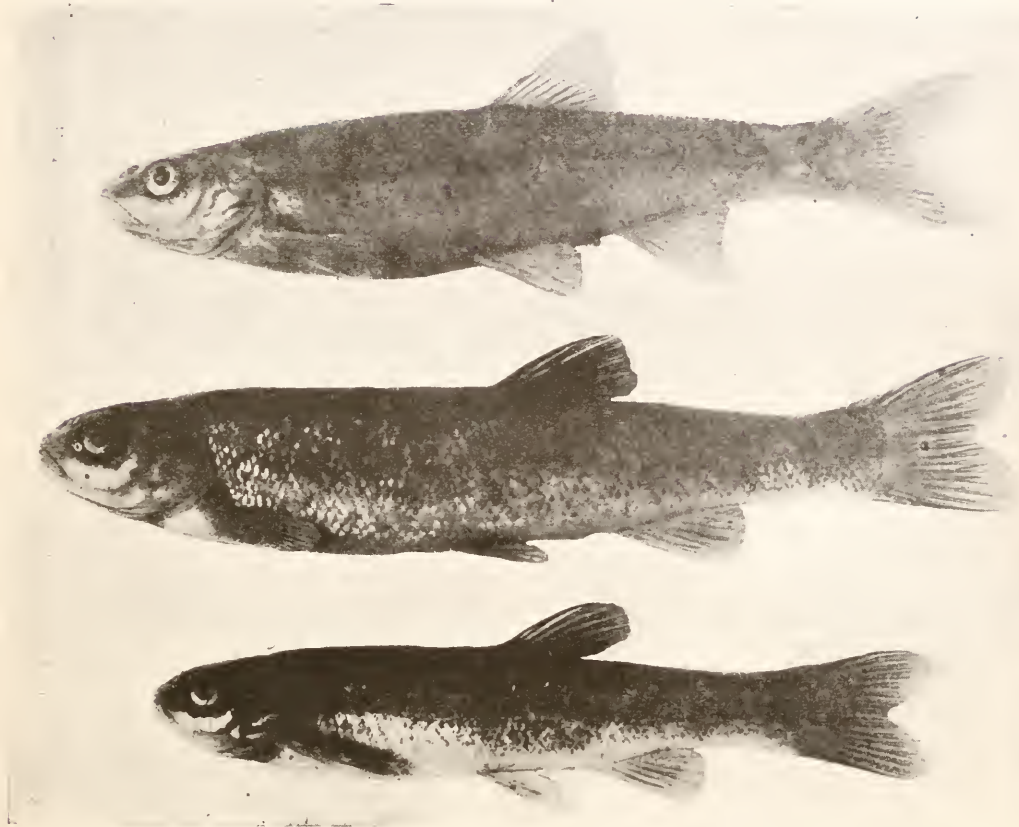
The accompanying plate shows an example of *C. plumbeus* above, and two Black Brook specimens of *L. rubrilateralis*, a female, and a male, below.

The type may be described as follows:—

Body robust, cylindrical, head and caudal peduncle slightly compressed; dorsal curvature less than ventral.

Head $4\frac{1}{2}$ - $4\frac{3}{4}$; depth 5; snout $4\frac{1}{3}$ in head; eye small, 5 in head, $1\frac{1}{3}$ in snout; D. 8, A. 8; scales 12-72-8 or 9.

Head short, rounded above; snout, bluntish; mouth small, oblique, lower jaw included; maxillary not reaching the orbit;



Conesius plumbeus (above) and two specimens, one male and the other female, of *Leuciscus rubrilateralis*.

barbel not evident. Teeth 2.5-4.2 normally, but number often reduced, frequently by absorption, hooked and without grinding surface.

Fins small, rounded; dorsal inserted well behind the ventrals, the tip, when depressed, over middle of base of anal; anal smaller than dorsal and of same shape; ventrals small, reaching nearly to vent in males, not so far in females; pectorals inserted low, and reaching half way to ventrals. Scales small, a little reduced and crowded anteriorly; lateral line complete at all stages.

Coloration, dull, bluish black above; duller on the sides and passing into white

below; a dark lateral band from black patch on operculum to base of caudal, sometimes not well defined anteriorly; a paler narrow band above, and scattered dark scales below; lateral surface below band, and extending from base of pectoral to caudal, red in breeding males; paler or wanting in females. Dorsal and caudal fins same color as the back; pectorals and anal dusted; ventrals whitish. Length 5-6 inches.

Rubrilateralis is very close to, if not identical with, *L. carletoni* Kendall, a species reported from the state of Maine by Dr. Wm. Converse Kendall, (*U. S. F. Com.*, Vol. XXII, 1902, pp. 357-8).

CANADIAN SPHAERIIDAE.

BY THE HON. MR. JUSTICE LATCHFORD.

(Continued from Vol. XXIV., p. 71.)

21. *MUSCULIUM SECURIS* Prime. This species resembles *t. truncatum* in the abruptness of the posterior margin, but is a smaller shell. Its anterior margin is shorter and more rounded, and the lines of growth are deeper and more distinct. The valves are thicker, less glossy, and paler within and without. It occurs on a muddy bottom in St. Louis Dam, inside the viaduct, and probably outside it; and in the pond north of the electric railway station at Britannia Highlands.

22. *MUSCULIUM WINKLEYI* Sterki. The ponds east and west of Britannia formed by the Ottawa at high water and several of the small streams in Nepean produce this pretty little shell in considerable numbers. It was described in the *Nautilus* (XXIII, 66) from specimens found by the Rev. H. W. Winkley near his home at Danvers, Mass., and at Old Orchard, Me. From this indefatigable collector and student of the *Sphaeriidae* I received from time to time during many years delightful letters and fine sets of rare or newly described species. *Winkleyi* resembles *securis*. The first specimens from the vicinity of Ottawa sent to Dr. Sterki were thought to be a variety of that species and were marked *M. securis cardissum*. It is, however, as the description states, higher than *securis* with more rounded outlines, the hinge margin is more curled, and the difference of size and shape between the anterior and posterior parts is less marked; in *securis* the posterior part is more truncate and less obliquely so to the dorso-ventral line.

23. *MUSCULIUM PARVUM* Sterki. In the same number of the *Nautilus* (p. 67). Dr. Sterki distinguished and described another shell usually confused with *securis*. The types were from Ohio, but the species has a wide distribution. It is not uncommon in the Britannia ponds, but has not been found elsewhere near Ottawa. It is smaller than *securis*, the superior margin is less curved, the posterior more rounded and more oblique; the surface shining, the shell colourless, the siphons are said to be

much shorter, connected, and colourless, while in *securis* they are yellow to orange, or salmon, or reddish. The Britannia shells correspond in size with the average measurements of the types: long. 4.7, alt. 4, diam. 2.8 mm.

24. *MUSCULIUM PARTUMEIUM* Say. In Heron's list of Ottawa Mollusca (Trans. O. F. N. C., 1, 40) this shell is included with a (?). The identification was probably correct as the species is not uncommon in many small ponds south of the city, near where Heron lived. When mature it exceeds *truncatum* in size, is brighter in color, more inflated and with higher beaks. It is not as large as *jayense*, nor so pinched in before and behind the hinge. From our *rosaceum* it differs in the greater projection of the beaks, and in being more distinctly yellow in color.

This species has a very extensive range east of the Rocky Mountains, and what is now considered to be a variety of it—*M. variable* Prime—occurs as far south as Florida. In Canada the shell has been found in Manitoba and at several places in Central Ontario. I have fine specimens from Hamilton collected by Mr. A. W. Hanham, and several from Humber Bay, Toronto.

25. *MUSCULIUM JAYENSE* Prime. This shell, while not as large as *transversum*, is much more beautiful, and is more characteristic of the genus. It is of a brighter color, shorter, higher, more inflated and more pinched in before and behind the hinge, giving the central area of the shell, as will be noticed in the figure,

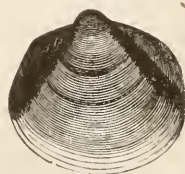


Fig. 5. — *M. jayense* $\times 1\frac{1}{2}$

a boldly triangular contour. The species has a wide distribution over the middle West and extends into Michigan, but does

not, as far as I am aware, appear recorded from the State of New York.

Lake Constance is the only locality near Ottawa or in Ontario in which *jayense* has been found. It occurs sparingly in two to three feet of water on a muddy bottom at the boat landing on the Vahey farm, near Armitage station. No other *musculium* was collected in the lake, though several doubtless occur. A large rough form of *Anodonta cataracta* abounds, and a beautiful variety of *Lymnaea emarginata*.

26. MUSCULIUM ROSACEUM Prime. Shells of unusual size and beauty found many years ago in the bay at the east end of the pond below the outlet of Meach Lake were considered by Tyron to belong to this species. Unfortunately but few specimens were collected, and the best of these were distributed to correspondents. Refuse from a saw mill destroyed the locality as a habitat for delicate molluscs, and I have been unable to visit the north side of Meach Lake, where a warm muddy bay would probably furnish the shell.

In the pond on the former Cowley farm in Nepean, about two hundred yards south of the electric railway, and near the boundary of the Ottawa Land Company's property, I collected in 1913 a quantity of a large *musculium* which Dr. Sterki regards as *rosaceum*. I have visited the pond nearly every year since but have not succeeded in again finding this shell. Other species persist in surviving the total drying up of the pond in hot summers; but this seems to have become quite extinct.

None of the shells found either in the Laurentides or Nepean has a tint that would justify the specific name applied by Prime. It may be that the soft parts are sometime rosy in color as is the case frequently in *Planorbis antvorskus*; but I have not noticed that peculiarity in any shells attributed to *rosaceum*.

Dr. Sterki states that this species has been found from Maine to Virginia, and in Ohio and Illinois as well as in Ontario.

27. MUSCULIUM ROSACEUM FULIGINOSUM Sterki. A smaller and differently colored shell, but with similar outlines, occurs at the bridge on the Tavistock Road, Britannia Highlands, and a mile or so westward in Honeywell Creek, where it crosses the John Road. It is the only *musculium* I have found in either locality.

While inclined to regard it as entitled to specific rank, I yield to the vastly superior experience and discrimination of Dr. Sterki, and append his description from his Preliminary Catalogue of North American Sphaeriidae (*Ann. Carneg. Mus.* X, 448.)

21. *Musculium rosaceum fuliginosum*, var. nov.

Mussel small, rather short, subequipartite, moderately inflated, somewhat "pinched" along the margins; beaks nearly in the middle, narrow, somewhat prominent, calyculate; superior margin angular at the beaks, its anterior and posterior parts straight or nearly so, equally sloping; supero-anterior and posterior slopes, or truncations, well marked, nearly straight, the posterior longer and steeper nearly at right angle with the longitudinal axis, anterior and posterior ends rounded; inferior margin moderately curved; surface shining and with a silky gloss derived from very narrow, membranous, scaly projections of the periostracum on the fine concentric striae: shell very thin, glassy transparent, with a marked grayish or smoky hue.

The largest specimen measures; long. 7; alt. 6; diam. 3.8 mm.

The mussel is striking in appearance and at first sight seems to be distinct, especially since all specimens are remarkably uniform, but young and adolescent individuals reveal features of other forms of *M. rosaceum*.

Habitat. Scott Graham Creek, Carleton County, Ontario, collected by Mr. Justice Latchford, 1911 and 1913. Specimens are contained in his collection and in the Carnegie Museum, Nos. 6,945 and 7,431. Justice Latchford writes in November, 1913: "No. 2925 is quite common. I have visited the creek at all seasons and never found any larger shells than those which I send; I therefore regard them—the larger ones—as full-grown."

28. MUSCULIUM DECLIVE Sterki. In Lake Gorman and in its outlet Brennan's Creek, near Brudenell, in Renfrew, was found a pretty little *musculium* which Dr. Sterki described as new (*Nautilus*, XXV, 103). It is about the size of *securis* and of a delicate yellow colour. Although exceedingly frail, like the shell on the Breton strand so beautifully described by Tennyson, it is capable of withstanding the waves and strong currents that so

often prevail over the sandy and gravelly floors of the lake and its outlet.

Dr. Sterki's description has, I think, been republished in the *Ottawa Naturalist* and need not be repeated. The shell has also been reported from Michigan.

29. *MUSCULIUM COLUMBIANUM* Sterki. In a mixed lot of shells sent me by the Rev. Geo. W. Taylor marked "Quamitcham, V.I." was a *musculium* which Dr. Sterki has described as new. I append his description from the *Nautilus*, XXVI, 117.

"*M. columbianum*, n. sp.—Mussel of medium size, strongly inflated, outlines (along the valve edges) oval to elliptic without any angles, beaks somewhat behind the middle, large, prominent, rounded or slightly flattened on top, or even calyculate: surface more or less uneven from lines of growth, somewhat shining, with fine irregular striae, color light corneous to yellowish often in alternating zones, shell thin subtranslucent; hinge rather slight, cardinal teeth small, the right curved with the posterior and thicker, left anterior with apex pointed, posterior quite short; ligament and resilium rather short and slight.

Long. 4.2, alt. 3.6, diam. 3 mm. (100: 86:71).

Long. 3.3, alt. 2.6, diam. 23 mm. (100: 79: 70).

Hab. British Columbia, apparently widely distributed, and common, and rather variable with respect to size and shape (no doubt also in Washington, etc.); vicinity of Esquimalt, collected by Mr. Taylor over twenty years ago, sent by Justice F. R. Latchford, No. 6362. Cotypes with the lot in Mr. Latchford's collection. Lots simply marked "B. C.", at least some of them from that vicinity, are in various collections; Chilliwack Creek and Lake, B. C., collected by a member of the Canada Geol. Surv. Staff, sent by Mr.

Whiteaves; a marsh, Duncans, B. C., received from A. W. Hanham. The first specimens were received in 1895, and the species has been regarded as distinct ever since.

30. *MUSCULIUM RAYMONDI*, J. G. Cooper. The late Dr. John Macoun sent me specimens of this shell from British Columbia, not stating the locality. The shell has probably a wide distribution in that province as it undoubtedly has southward in Washington, Oregon, and California. It resembles *securis* but with the posterior part of the mussel markedly higher than the anterior.

31. *MUSCULIUM LENTICULA* Gould. This shell is mentioned by Dr. Dall as occurring in British Columbia (Harr. Alaska Exp., XII, 140), and on his authority I give it a place in the Canadian list. The only specimens I have seen are from California.

32. *MUSCULIUM LACUSTRE* Muller. Dr. Sterki (*Ann. Carneg. Mus.*, X, 442) gives the habitat of this species as Palearctic and Nearctic Regions, Indiana, Ontario (and probably northward), California and Washington." He thinks that some of the shells considered by Dr. Dall to be *lenticula* may belong to this species.

There are several lots of *musculia* in my collection of doubtful identity. One from the small pond southwest of the intersection of the Rideau Canal and the Chaudiere branch of the Canadian Pacific Railway may be undescribed. Two others from Vancouver Island, Nos. 2364 and 2365 (b), are said by Dr. Sterki to appear not to belong to any described species.

In the continuation of this paper I shall deal briefly with the remaining genus, *Pisidium* — very largely represented in Canada in both individuals and species.

A BABY PORCUPINE.

BY CHARLES MACNAMARA, ARNPRIOR, ONTARIO.

It was early in May on the shores of that expanse of the Ottawa known as Lac des Chats. The Ornithologist had disappeared into the thicket, following an unknown and elusive bird voice — goodness knows it must have been a *rara avis* when the Ornithologist did not know it — and I

was left searching a pine stump for certain minute insects. After a while I began to wonder when he was coming back, for he was carrying the lunch in his rucksack, and breakfast seemed to have happened a long time ago. Suddenly he hurried around a turn in the log-road, and, a little

out of breath, he said: "I shouted for you but couldn't make you hear. I saw a fine big porcupine back there, and it climbed only about four feet up a tree. You can easily get a great photograph of it."

"Back there" proved to be a low rocky ridge thickly grown with cedars and balsams. It was only about three minutes' quick walk from the pine stump, but when we arrived with the camera ready set, the big porcupine had utterly vanished, and careful searching of the surroundings yielded no result—at least in *big* porcupines. For just as we were giving up the quest, the Ornithologist caught sight of a small jet-black creature trying to hide under a cedar root. It was a baby porcupine about the size of a half grown cat. No doubt the large porcupine was his mother, but maternal instinct had failed in this case and she had deserted her offspring. The long grey-tipped hair of the adult had not grown on him yet, and he looked very black in his short under-coat. Porcupines are remarkably large when they come into the world, and although this one seemed well started in life, he was probably very young. Nevertheless he bristled his spines and slapped at us with his tail like the oldest and surliest of his race.

As a rule I am opposed to keeping wild animals in captivity, but I thought if I could feed this little fellow at home for a short time, I might learn something interesting about porcupine ways, and later I could set him free again. So while the Ornithologist hurriedly emptied our precious lunch out of the rucksack, I tried to loop my handkerchief around the porcupine so as to work him out from beneath the root, for I knew what would happen to me if I touched him with bare hands. But it could not be managed that way; there was nothing for it but bare hands after all, and they looked like well furnished pincushions by the time he was hustled into the bag. His spines were only about one quarter the length of those of the full grown animal, but they were twice as sharp. I pulled them out, one by one, with my teeth, and each of them left a drop of blood after it. Then I picked up my handkerchief and wiped my fevered brow, and a good stout spine stuck firmly

in the end of my nose. I began to understand how the story started that porcupines can shoot their quills at an enemy.

Except for an occasional puppy-like whine, he lay quiet in the bag all the way home. There I fitted up a roomy box for him with a bed of fresh cedar branches, and a partition behind which, if he wished, he could retire from the garish day. And I furnished a provision of lettuce leaves, pieces of apple and a saucer of milk. But it was plain next morning that he had eaten nothing. Then when cabbage leaves and succulent willow and poplar twigs failed to attract him, I concluded that he was too young to take solid nourishment, and I tried to draw his attention to the immense advantages of milk as a food. But all my friendly advances were sullenly rejected. He put down his head and bristled his back, and looked at me with a dull but rancorous eye.

About all you can do to tame a porcupine is to speak kindly to him. You cannot try to win his confidence by scratching his head or stroking him soothingly down the back. Evidently firmer measures than well-meaning words were needed here. From former experience I knew that even large porcupines can be handled safely, if unsympathetically, with a pair of heavy leather mitts; and it was with this equipment that I made the little fellow immerse his nose in the milk, hoping that he would begin to lap it; but he wouldn't. Then I dipped my fingers in the milk and rubbed them over his lips. He registered his objection to this treatment by a squeal, but he made no attempt to bite. Porcupines never do bite in anger; their quills are their sole defence. Next I tried to feed him from a bottle, but neither the mouthpiece improvised from the rubber bulb of a pen-filler, nor what the drug clerk assured me was the best make of anti-colic feeder for human infants, met with his approval, and he whined and kicked and left dozens of quills stuck in my mitts. He had gone on a determined hunger-strike, and all my efforts ended in getting no more than a teaspoonful of milk down his throat, and that only with much trouble and disturbance. However, his fasting seemed to have done him no harm,

and between attempted feedings he climbed around his box briskly enough for a porcupine. But his occasional fits of crying were distressing.

At last on the third day of his captivity I thought of a friendly correspondent, Mr. Linwood Flint of North Waterford, Maine, who is probably more intimate with porcupines than anyone else in the world, as he rears them for sale on a "Porcupine Farm". A query addressed to him by telegram as to what to do with a baby porcupine that wouldn't eat anything brought the prompt but disappointing reply, that it was impossible to rear a young porcupine away from its mother. This dashed my hopes of porcupine study, and my only care now was to get the little creature back to his mother as soon as possible. For the last time I got my mitts full of quills while putting him into the rucksack, and just at nightfall I reached the rocky ridge where I had found him. The long walk was lightened by hearing on the way the meditative notes of the first hermit thrush of the season, and a red deer was startled from the path and leap-

ed exquisitely over a log into the bushes. As I emptied the little creature out of the bag I had an absurd feeling of basely abandoning an infant in the wilds. But this was home to him, and as he moved off deliberately into the darkling cedars, his final leave taking was an angry flip of his spiked tail. I did not blame him; he had no reason to feel grateful to me. That night, when going to bed, as I was walking around my room in bare feet a sudden sharp pain took me in the toe. It was a last physical reminder of the little porcupine—a slender needle-sharp spine driven into my flesh.

Next day I visited again the place where I had left him, and searched thoroughly all around the spot, but discovered no trace of him. So I have no doubt that his mother, who I am sure lives somewhere in the neighboring rocks, heard his plaints in the night and came to him. And I like to think that when I was looking for him that afternoon he was safe in a nearby rock crevice, with a full stomach, fast asleep.

NOTES ON CANADIAN ENTOMOSTRACA.

By A. BROOKER KLUGH, M. A., Queen's University, Kingston.

The fresh-water Entomostraca have up to the present received very little attention in Canada. The only Ontario records, so far as I know, are those of Dr. G. O. Sars, who reports on 16 species, collected at Go-Home Bay, Muskoka, in 1907, by Dr. E. M. Walker, in "Contributions to Canadian Biology, 1911-14, Fasc. 2", and of Prof. Acheson, who in "Proc. Can. Inst., Ser. 3, Vol. 1" lists *Daphnia Pulex?* and *Cyclops quadricornis* as occurring in Toronto tap-water. With regard to these last records, it is possible that *Daphnia pulex?* was really that species, but it is more likely to have been one of the *D. Longispina* group, which are inhabitants of open water, while *Cyclops quadricornis* is a name which was at one time used for what are now regarded as several distinct species.

These minute crustaceans are of great economic importance, because a great many of our fresh-water food and game fishes,

during their young stages, feed to a very large extent on Cladocerans and Copepods, while these same Entomostraca constitute the chief food-supply of the smaller species of fresh-water fishes, which in turn are preyed upon by many of the larger fishes. The Entomostraca are thus one of the chief links in the chain of food-relations which leads from the fresh-water algae to the commercial and game fishes of our inland waters.

In regard to distribution the different species of Entomostraca differ markedly, some, as *Chydorus sphaericus*, being practically cosmopolitan, while others are apparently extremely local.

The following records, obtained in 1920, are presented as a preliminary list of Canadian Entomostraca, to which I hope to add from time to time as my investigations on this ground continue.

ORDER CLADOCERA.

Diaphanosoma leuchtenbergianum, Fischer. Frequent in plancton at 1 metre in Lake Missanag, Frontenac County, Ont., Aug. 30.

Holopedium gibberum, Zaddach. Scarce in surface plancton, Lake of Bays, Muskoka, Ont., Aug. 24.

Daphnia pulex de Geer. Well water, Guelph, Ont. Well water, Harrowsmith, Ont. Pool in woods, Aylmer, Ont.; collected by H. C. White.

Daphnia longispina hyalina, Leydig. Common in surface plancton, Lake of Bays, Muskoka, Ont., Aug. 24. Abundant in surface plancton, mouth of the Cataraqui River, Ont., Nov. 5.

Daphnia longispina hyalina mendotae, Birge. Common in surface plancton, mouth of the Cataraqui River, Ont. Nov. 5.

Simocephalus retulus, O. F. Müller. Common among decaying vegetation at the bottom of a shallow channel in a marsh on the Cataraqui River, Ont.

Ceriodaphnia megalops, Sars. Scarce in the same habitat as the preceding.

Bosmina longirostris, O. F. Müller. Common in surface plancton, Lake of Bays, Aug. 24. Common in surface plancton, mouth of the Cataraqui River, Ont.

Bosmina longispina, Leydig. Common in plancton at 1 metre, Lake Missanag, Ont., Aug. 30.

Alona guttata, Sars. Scarce in surface plancton in shallow channel in a marsh on the Cataraqui River, Ont., Nov. 5.

Chydorus sphaericus, O. F. Müller. Common in surface plancton, mouth of the Cataraqui River, Ont., Nov. 5.

Polyphemus pediculus, Linn. Frequent in plancton at 1 metre, Lake Missanag, Ont.

ORDER OSTRACODA.

Cypridopsis vidua, O. F. Müller. Com-

mon among aquatic vegetation at mouth of the Cataraqui River, Ont. Common in a marshy pond near Kingston, Ont.

Cyclocypris lacris, O. F. Müller. Common among filamentous algae at the mouth of the Cataraqui River, Ont.

Cypris dentata, Sharpe. Abundant in a pool near Kingston, Ont.; collected by H. C. White.

Cypris testudinaria, Sharpe. Common in a pool in the woods, Aylmer, Ont., May; collected by H. C. White.

ORDER COPEPODA.

Diaptomus oregonensis, Lilljeborg. Abundant in plancton at 1 metre, Lake Missanag, Ont. Common in surface plancton, mouth of the Cataraqui River, Ont.

Cyclops bicuspidatus, Claus. Common in surface plancton, Lake of Bays, Ont., Aug. 24. Common in surface plancton, mouth of the Cataraqui River, Ont., Nov. 5. Common in surface plancton, Lake Ontario, Dec. 15.

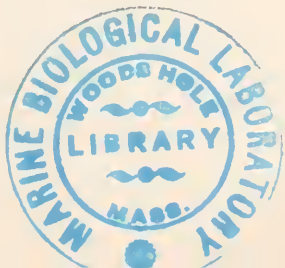
Cyclops viridis brevispinosus, Herrick. Common in plancton at 1 metre, Lake Missanag. Aug. 30.

Cyclops fimbriatus, Fischer. Scarce in channel in marsh at mouth of Cataraqui River, Ont.

Canthocamptus minutus, Claus. Scarce in surface plancton, Lake Ontario at Kingston, Dec. 15.

N. B. — Since the above was written, copies of Parts H and J of Vol. 7 Report of the Canadian Arctic Expedition containing records of Arctic Cladocera by Dr. Juday and Copepoda by Dr. Marsh have come to hand.¹

¹ Dr. Robert Chambers in Biological Bulletin, Vol. 22, p. 293, mentions the occurrence of *Cyclops parens* and *C. Americanus* at Toronto. The Euphyllopoda and parasitic Copepoda have not been considered. — Ed.



A BOTANICAL TRIP THROUGH GERMAN SOUTH-WEST AFRICA.

By W. P. THOMPSON.

In 1912 the writer visited the former German colony in south-west Africa chiefly in order to secure material of *Tumboa* (*Welwitschia*) *mirabilis*, *mirabilis* both from the morphological and physiological standpoints. It was necessary to make a trip across a very extreme desert whose scanty flora exhibits remarkable xerophytic adaptations. The conquering of this colony by the late General Botha and General Smuts and the future probable relationship of the territory to the British Empire under a mandatory held by the Union of South Africa may lend a special interest to the following notes on that trip.

Landing at Swakopmund on the west coast, one is in a region in which, according to the official German records, the rainfall averages about one inch a year, though many years may pass with no precipitation. At the time of my visit the natives could not remember when the last rain had fallen but were sure that whenever it was it had been only a sprinkle. As one proceeds eastward the rainfall increases slightly but at no place amounts to more than ten inches annually. Apparently in all this portion of the continent the rainbearing winds cross Africa from the Indian Ocean losing their moisture on the way. The natives stated that the sprinkles always came from the east. In the British territories across to the east coast the rainfall is much heavier.

This distribution of moisture available for the vegetation is modified in a remarkable way by the fact that several old dry river beds cross the colony from east to west. Apparently the climate was formerly much moister than at present. Occasionally heavy rains in the British territories to the east cause the water to flow down these old river beds. Sometimes the flood nearly reaches the sea before being absorbed. For long afterwards these valleys support a vegetation different from that of the surrounding desert. They are then long band-like oases.

For many miles from Swakopmund, outside the dry bed of the Swakop, one can find only three species of plants and very

few specimens of them (a *Zigophyllum*, a *Mesembryanthemum* and an *Arthaerua*). They look like haycocks on an immense field of sand. In addition to the lack of moisture these plants have to contend with the continually wind-driven sand. All day long the presence of the fine particles of sand in the air makes the horizon as highly colored as one of our sunsets. The sand lodges against the plants and tends to submerge them while the plants strive to surmount the rising sand. In this way high dunes are built up round a single plant. Usually the plant is beaten in the struggle with the sand which later blows away and leaves the dead plant exposed. The only other vegetation of this strip near the sea consists of numerous orange-colored lichens on the desert rocks. These appear to derive their moisture from the heavy dews, so heavy that on many mornings they drip off the roofs of the houses in Swakopmund. In fact it is difficult to see how even the flowering plants can survive unless they utilize these dews.

As we went inland by broad-wheeled carts following the route from Swakopmund to Windbuk (the capital) later followed by General Botha, we found new plants making their appearance as increasing moisture enabled them to survive. After a time we met outlying specimens of the famous "good Karoo bush" (*Augea*) on which the still more famous sheep of the South African farmer largely subsist. At fifty miles from the coast we found *Tumboa*, the chief object of the trip.

This remarkable plant is like a huge turnip bearing throughout its life only two leaves which soon become torn to narrow shreds by the wind. In adult specimens the body is five or six feet in diameter and the leaves stretch for twenty feet across the desert sand. As the plants may be more than one hundred years old the length of life of its two leaves far exceeds that of any other known leaves. The centre of the turnip rots away leaving a narrow atoll-like rim of stem above the sand. *Tumboa* is a member of the order Gnetales, the highest of the Gymnosperms which show in nearly every structure ap-

parent transitions to Angiosperms. It bears cones like gymnosperms but in the axil of each scale is a flower of Angiospermic structure. Its distribution is no less remarkable than its morphology. In this locality it is found in an area of only a few square miles. This and another similar locality further north are the only places in the world where it is found.

Tumboa's neighbors have adopted varied methods of contending with the drought. The Naras, *Acanthosicyos horrida* (Cucurbitaceae), has completely discarded its leaves and consists simply of a mass of green, hard, extremely sharp pointed thorns sprawling over the sand. Its roots go down to subterranean water and may be fifteen meters long. The Geraniaceous *Sarcocaulon* has completely waterproofed itself in a coat of hard wax which may be ten millimeters thick. The coat remains as a hollow shell long after the plant has died and rotted away. The wax burns readily and the plant is therefore called Hottentot candle. Several species have imitated the succulent cactus though belonging to very different families. Several members of the milkweed family have become switch plants. Strangest of all perhaps in this climate is the ice-plant (*Mesembryanthemum*) with its large soft leaves completely covered by droplets of cool liquid. To expose its water in this way when the supply is so extremely scanty seems to be about the worst thing the plant could do.

A fact which soon strikes the botanist is that in spite of strong resemblances in external features to the plants of American deserts these belong to very different families. For example, one sees many cactus-like plants but no cacti. A large proportion of the flora consists of members of the milkweed family which are there switch-plants. Families which the North American botanist has never seen there simulate our own xerophytes to a remarkable degree. So strong is the resemblance in many cases that one can scarcely believe that the flowers, showing the true botanical relationship, really belong to the plants on which they are found. We have here a good illustration of entirely unrelated plants acquiring the same characteristics under similar conditions.

During the whole trip only one species of our great rose family was seen, only three crucifers and only three members of the buttercup family (all *Clematis*). On the other hand, families poorly represented here but relatively abundant there are the Asclepiadaceae, Tiliaceae (chiefly shrubby *Grewias*), Geraniaceae, Aizoaceae, Zygophyllaceae and Anacardiaceae. Families with many representatives in both places are Liliaceae, Leguminosae and Compositae.

The old river beds constitute an interesting variation from the desert waste. Their periodic flooding from the interior enables a richer though still sparse vegetation to survive. An occasional gardener takes advantage of this moisture to raise a few vegetables which are sold at fabulous prices to the town dwellers. A number of large wells as big as a house are dug in the dry river bottom. Into these a little water soaks during the night and is pumped out next day on to the small garden. After a time the wells go completely dry and the gardener moves a half-mile along the river and digs a new set. Sometimes several moves are made between floodings.

In these river bottoms the vegetation consists chiefly of scattered shrubs and trees. There are the date palm, a fig, several thorny acacias, the tamarisk and an ebony. One of the most successful plants in this habitat is a tobacco (*Nicotiana glauca*) which reaches the size of a small tree. It was introduced by the early missionaries.

Farther inland the increased moisture supports a somewhat richer vegetation. In places the vegetation is of a type which rapidly bursts into flower after a rain and then dries up until the next rain. In few places is the ground completely covered, the plants being in scattered clumps and consisting chiefly of grasses. The German Government had encouraged in every possible way the agricultural development of the colony, but even the best parts of the country are unsuited to anything but ranching. The few ranchers who had been induced to settle in the eastern portion were making a precarious livelihood at the beginning of the war. A few municipalities in Canada are worth more agriculturally than the whole territory.

SWARTH ON THE FOX SPARROW.

By P. A. TAVERNER.

This monograph on the Fox Sparrows is an excellent example of the species-splitter at his best, and worst. That sixteen subspecies are recognized is testimony to the fineness of the splitting, but the use made of these fragments goes a long way to justify the process. Too often systematists have assumed, when they have divided their species into as many fractional parts as possible, that their responsibility was ended, whereas they have only just laid out their tools for serious scientific effort. Mr. Swarth realizes that splitting is a means to an end and not an end in itself, and has developed his subject with a grasp and appreciation of the problems involved that is all too rare in revisions of this kind.

The first 29 pages are taken up by an introduction and chapters on Materials and Methods of Treatment, History, Variation in *Passerella iliaca* and Distribution and Migration that are models of their kinds. The remainder is composed of systematic treatment, description and discussion of the races considered, a list of all the material examined and a beautifully drawn and colored plate from the brush of our countryman Major Allan Brooks illustrating the extremes of two subspecific groups.

The species is remarkably homogeneous over most of the continent but breaks up into many races within and west of the Rocky Mountains. These races are discussed, their relationships pointed out, they are traced from their summer to their winter habitat, and many interesting problems regarding them are suggested.

An interesting conclusion is derived from the movements and distribution of the British Columbia and Alaska coastal forms. Those that summer farthest north winter the farthest south. The more southern breeders winter more northerly, and so on progressively to the Vancouver Island vicinity birds which are practically stationary throughout the year.

Another important point brought out is that the birds breeding in the most humid climates are not the darkest or the largest of the species. *Unalaschensis*, summering in the extremely moist Alaskan Peninsula,

does not reach the extreme development of size or depth of color that is attained by *fuliginosa*, resident on the comparatively dry Vancouver Island region. This perplexing fact that would otherwise seriously shake one of our most cherished ecological principles is explained by the fact that the northern race spends its winter in arid southern California, and probably experiences a much lower annual average moisture than does the darker and larger race. It is thus brought forcibly to our notice that, in studying the relationship between the bird and its environment, winter ranges and probably migrational routes should also be taken into consideration.

Some distributional anomalies are pointed out. Some forms range widely over varied and more or less discontinuous conditions unmodified, whilst very slight barriers have induced specialization in others. Kadiak Island, but slightly isolated from adjoining territory, has its definable subspecies, *insularis*, yet the Queen Charlottes, situated far out to sea and noted for their peculiar forms, have developed no specialization in this species.

Mr. Swarth divides the Fox Sparrow, *Passerella iliaca*, into sixteen subspecies falling into three groups which for convenience he calls after their most characteristic component members. Thus he gives us:—

I.—The Iliaca group.

1. *P. i. iliaca*
2. *P. i. altavagans*

II.—The Unalaschensis group.

- | | |
|-------------------------------|----------------------------|
| 1. <i>P. i. unalaschensis</i> | 4. <i>P. i. annectens</i> |
| 2. <i>P. i. insularis</i> | 5. <i>P. i. townsendi</i> |
| 3. <i>P. i. sinuosa</i> | 6. <i>P. i. fuliginosa</i> |

III.—The Schistacea group.

- | | |
|------------------------------|----------------------------|
| 1. <i>P. i. schistacea</i> | 5. <i>P. i. canescens</i> |
| 2. <i>P. i. fulva</i> | 6. <i>P. i. monolensis</i> |
| 3. <i>P. i. megarhynchus</i> | 7. <i>P. i. mariposae</i> |
| 4. <i>P. i. brevicauda</i> | 8. <i>P. i. stephensi</i> |

Of these we have nine in Canada either as breeders or migrants, including all the first two groups and the first of the third.

Iliaca, characterized by foxy color, ranges all over eastern Canada to the Rocky Mountains and Central Alaska. In the mountains, through *altavagans* it approaches *schistacea*, which is characterized by the reduction of red and a great increase of slaty color. *Altavagans* and *schistacea* occupy most of the interior of British Columbia. The *unalaschensis* group are large maroon-brown birds occupying the coast, from *fuliginosa*, resident in the Vancouver Island vicinity, through *townsendi*, *annectens*, *sinuosa* and *insularis*, to *unalaschensis* of the Alaska Peninsula.

In the systematic body of the paper, dealing with the description, salient characters and ranges of the forms dealt with, are many illustrative drawings, maps, etc. The whole is admirable in plan and construction and clearly presented. It is not until we come to study carefully the drawings of some of these distinctions that any doubt is awakened as to the expediency of perpetuating all these many names. Distinctions that seem clear and satisfactory in print in some cases become very faint in illustration. Whilst we can be assured that they are the best possible presentation of the case many of them can be felt rather than seen. A small amount of individual variation would swamp some and even the inescapable personality of the draughtsman may be a determining factor. In the excellent colored plate by Allan Brooks *brevicauda* and *unalaschensis* are seen to be so much alike in color that the otherwise excellent three-color process plates have absolutely failed to differentiate them. When it is realized that average characters are regarded as sufficient basis for subspecies making and that the author calls special attention to the number of intermediates in his material one can be pardoned for harboring some mental reservations.

In this connection the reviewer is fortunate in having access to some of the material upon which the work is based and that bears the author's determinations. A careful examination of it in comparison with the text does not allay all doubt. Specimens of *altavagans*, referred by the author to the *Iliaca* group seem more closely related to *schistacea*, in plumage barely separable from it. The *Unalaschensis*

group, represented in the material by all but *insularis*, shows a gradual gradation from the comparatively small and lighter colored northern *unalaschensis* to the big, dark *fuliginosa* of southern British Columbia. These gradations are postulated by the writer to occur in marked steps with alternate distributional areas of constancy and variability. It is neither safe nor just to pass final judgment on the suddenness of these variations without having seen all the material upon which the conclusions are based, but the slightness of the characters and the limitations of collecting on a long line of uninhabited coast naturally make one wonder whether the gradation is not a little more gradual than is assumed, and but indicates extended intergradation in which perhaps all characters do not change at an equal rate, and where there are possibly occasional disturbing factors.

Whilst we do not seriously doubt that most if not all of these differences exist, or that Mr. Swarth can see and differentiate them, we admit our inability to do so in some cases and doubt whether any one else without his natural aptitude, amount of material and the obvious concentration he has put upon it can be trusted to identify many of these laboratory varieties. Identification of Fox Sparrows to the Swarth standard thus becomes a one man's work and is practically impossible of verification or intelligent correction by others. However, fitted in this case that one man may be in keenness of perception, honesty of purpose and balance of judgment we tremble at the results that may arise from the use of these minute subdivisions in the hands of the less experienced or responsible. This is certainly no work for the dilettante, and we question the expediency of presenting undemonstrable races for the use of the general public.

It is notable that when Mr. Swarth came to make a serious study of this species he was not content to accept the determinations of *anyone* else, but very properly went to the original material and carefully worked it all out again to his own satisfaction. And thus it must ever be when serious use is made of subspecific variation in constructive science. Of what use have been the numerous trinominals applied to Fox Sparrows in the many local

and other published lists? As far as Mr. Swarth was concerned they were no more than specific binomials. In this connection it is interesting to note that the author consistently applies the binomial *Passerella iliaca*, the Fox Sparrow, to all the subspecies collectively, and differentiates the type form as the Eastern Fox Sparrow *Passerella iliaca iliaca*, definitely naming it as a subspecies on a par with the others. All this is in perfect harmony with the views for which the present reviewer has lately been severely criticised. There seems much in this paper to justify his stand.

It is also to be noted, as showing a natural trend of the present subspecies maker, that the author has found it expedient to use group names for associations of his subspecies; so we have arrived at the stage of the super-subspecies in spirit if not in fact. With an extension of this principle and more thoroughly developed perceptions we are faced with the possibility of super-subspecies and sub-subspecies until we may be forced to adopt algebraic formulae or chemical symbols for the representation of the more involved relationships, an eventuality not without some promise.

These groups as defined by Mr. Swarth are plainly recognizable entities and as such must be taken into consideration as well to systematize a complicated idea as to properly reflect zoological facts. The component parts of these groups are, as said before, less obvious and it is debatable whether or no it is not sufficient for the general worker to lump them under their group associations, leaving the

finer determinations to the specializing expert. In this particular case, one solution naturally suggests itself.

It does not appear that Mr. Swarth with all his material has demonstrated actual intergradation between these three groups. In fact he remarks that they approach but remain distinct. Might it not be well then to acknowledge the apparent logic of the evidence and raise them to the specific status to which they seem entitled? The evidence is as strong in this case as for the Oregon Junco, the Northwest Crow and others that may be mentioned, and is strengthened by the fact that the Eastern Fox Sparrow is a particularly constant form, while the western races are highly variable, suggesting a fundamental distinction between them at last.

In spite of all the above criticism, either stated or implied, Mr. Swarth is to be congratulated on the presentation he has made of his thesis. The faults, so judged by the reviewer, are those of prevailing practice, the virtues are all his own. The necessity of studying even the finest variations is not questioned, the necessity of dignifying all of them with formal names and thus exalting their importance to a par with those of demonstrable status is doubted. The question is one of expediency rather than of fact. However this may be, the thoroughness which is evidenced throughout, the care that has been taken to provide the widest basis of material, the keenness with which the author has analyzed his phenomena and the clarity with which he has stated them and his conclusions makes this one of the noteworthy specific revisions.

NOTES AND OBSERVATIONS.

BIRD BANDING.

The work of bird banding, from which so much may be learned concerning the life history of birds, has been taken over from the Societies which were carrying on this work by the U. S. Biological Survey. All success is wished the Survey in this line of endeavour.

The following article is printed at the request of the Biological Survey, to ac-

quaint the public of Canada with this work.

CHECKING UP THE MIGRATION OF BIRDS.

"The desire to learn what became of birds that flew South with the approach of cold weather led Audubon—the great American naturalist—to place silver threads about the legs of a brood of phoebes. The following spring he was rewarded by having two of the birds re-

turn to nest near the haunts where they learned to fly.

"This occurred early in the nineteenth century, and was the first known case in America of bird banding. Since that time this means of securing information on the movements and life history of migratory birds has been used by many societies, and every fall thousands of birds fly south bearing a narrow ring, stamped with a number, about one of its legs.

"So valuable is this work, especially with game and insectivorous species of birds, that in 1920 the United States Department of Agriculture took over the experiments being conducted by the American Bird Banding Association, the society's work having outgrown its available resources. Since it is the returns from bird banding that furnish the data desired in this branch of research, it is of prime importance that the methods employed be improved and that the percentage of birds under observation be increased. To assist co-operators in this work, the department has published Department Circular 170, Instructions for Bird Banding, which is just available for distribution.

"It is the plan of the Biological Survey of the department, which is supervising the bird-banding work, to advance this method of research along two principal lines: first, the banding of fledglings as formerly practiced; and second, the systematic trapping and banding of adult birds. As the banding of fledglings has the advantage of affording valuable information on the ages of birds, the survey wishes to encourage these activities, but it desires to lay special emphasis on the added value of the systematic trapping of adults.

"With the establishment of a well-connected chain of trapping stations throughout the United States and Canada, regular 'returns' are confidently expected by department specialists with reports of retrapping birds that had been banded at the original and other stations. Data thus afforded are already indicating the exact lines of migration of individual birds, the speed of travel, and innumerable items of interest, many of which have a direct bearing upon the study of

life histories and the administration of the Migratory Bird Treaty Act with which the Department is charged.

"The department issues bands of two types to co-operators in the work. One type is the split ring band for all small birds, and the other is the flat strip band that is adjustable for all large birds. For general land-bird trapping the so-called Government 'sparrow trap' has been found the most satisfactory. The bulletin contains details of construction of this trap. It also discusses other methods of trapping, the operation of traps, handling and releasing birds, and filling out reports. Federal trapping permits for this work are required under the Migratory Bird Treaty Act. Applications for permits and requests for the bulletin should be addressed to the Bureau of Biological Survey, Department of Agriculture, Washington, D.C."

In Canada, applications for permits to carry on this work should be made to the Commissioner, Canadian National Parks, Department of the Interior, Ottawa. Persons holding federal permits to take birds for scientific purposes require no other permit. It would be needless duplication for records of banding to be kept in the U. S. and Canada, as the birds do not respect our boundary in their migration; consequently the records for the continent are being kept at Washington.

PROBLEMS THAT CAN BE SOLVED BY BIRD BANDING.

1. How fast do the individuals of any species travel on their periodic migrations; that is, how many miles per day will any one bird average during these journeys and what is the total time consumed in a trip?
2. Does any one flock continue in the van or is the advance made by successive flocks passing one over the other in alternate periods of rest and flight?
3. Do individuals of any species always follow the same route, and is it identical for both spring and fall flights?
4. Do migrating birds make the same stop-overs every year to feed?
5. How long do birds remain in one

locality during the migration, the breeding, or the winter seasons?

6. What is the relation between the breeding and the wintering grounds of individuals; that is, do those birds that breed farthest north, winter farthest south, thus jumping over those that occupy the intermediate zone, or do they merely replace the latter individuals as winter residents?

7. Do birds adopt the same nesting area, nest site, and winter quarters during successive seasons?

8. For how many broods will one pair remain mated, and which bird, if not both, is attracted next year to the old nesting site?

9. To what extent do males of a species assist in incubating and brooding?

10. How far from their nests do birds forage for food, and after the young have left the nest, will the parent birds bring them to the feeding and trapping station?

11. To what regions do the birds go, particularly the young, that do not return to the vicinity of their original nests?

12. How long do birds live?

For the solution of these and related problems, it is important that the traps always be set on the original site, for birds already have returned to the same traps through four or five consecutive seasons. Many "returns" will, in the course of time, afford answers to the important problems here presented.

NIGHTHAWK NESTING IN A PEAT BOG. — On June 4th, 1921, we were in pursuit of Lincoln Sparrows, Yellow Palm and Myrtle Warblers in a large open peat bog located on the south shore of the Gulf of St. Lawrence. The vegetation was mostly Labrador tea and rich green mosses fully a foot in depth, with spruces moderately spread out all over the territory. This is a wonderful country for bog-loving species, — Lincoln and Swamp Sparrows, Wilsons and Yellow Palm Warblers being actively occupied in domestic duties. The White-throat's whistle, always welcome, could also be heard from all sections of this beautiful bogland.

As is sometimes the case the unexpected happens and one receives a pleasant surprise. Here and there were scattered patches of sun-baked peat and from one of these a Nighthawk departed rather reluctantly, disclosing a single egg. The nesting site chosen was slightly off elevated ground and was sheltered from any high winds that might occur. There was no attempt at nest building, merely a feather of the female lying alongside the egg. Two days later we found that the Nighthawk had taken exception to a handkerchief tied to the branches of a spruce as a landmark, or perhaps she detected, in this sign of the human, evidence of further intrusion. In any event the egg had disappeared and the bird, no doubt, exercised her privilege of retiring to another secluded spot some distance away, as further efforts on our part failed to locate her.

W. V. BROWN, Westmount, Que.





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OVERGROWTH OF STUMPS OF CONIFERS.

BY C. C. PEMBERTON.

Perhaps the most remarkable feature in connection with the subject of the overgrowth of stumps of certain conifers is the fact that many botanists have never heard of the existence of this phenomenon. This is all the more remarkable as it is a phase of vegetable life which has been observed in different parts of the world for a long time and various authorities have, from time to time, published references to it.

The findings of those who have investigated this subject in one country often do not seem to have been known to those in another, later writers being apparently unaware of previous investigations. Evidently the references published in the past have attracted little attention and the subject has been speedily forgotten.

I have found that many plant physiologists, on learning of the phenomenon, incline to the idea that the overgrowth is the result of a mysterious power in the reserve material of the stump which enables it to continue indefinitely to form woody matter without aid of foliage or organs of assimilation of any kind. They comment on the fact that broadleaf trees, and even larch, can have their felled stems make a limited amount of callous growth in the spring following the felling. Other physiologists from the first have deemed the reserve material explanation utterly inadequate and have considered the continuity of vitality, healings and bulky formations of cappings of new wood to be possible only by parasitism—of some sort—with a chlorophyll-possessing host plant.

Some years ago, when I took up the study and investigation of the characteristics of the native trees in the environment of Victoria, I found it impossible to discover any authoritative writings on the subject of these stumps, but by degrees I learned that the matter had received at-

tention from several writers. Unfortunately the full texts of these publications have never been obtainable here, and I have, therefore, been unable to ascertain to what extent investigations have been carried.

From Mr. A. D. Webster, whom I first met when he was Superintendent of Regent's Park, England, I have learned that the English forester, Grigor, (who died in 1848) had, in his book *Arbiculture*, referred to the power of coniferous trees to continue the formation of healings and new wood after the loss of their stems and foliage; that while this statement had been scoffed at by subsequent French reviewers of the book, Mr. Webster's father, Mr. John Webster, who had noted the characteristic in Larch, Silver Fir, Scotch Fir and Spruce, had by production of actual specimens been able to prove that Grigor was correct in his assertions; and that the findings of Mr. John Webster had then been published in an essay "On the Growth of Roots of Coniferous Trees After being Felled," which appeared in the *Transactions of the Highland Agricultural Society*, No. 111, Fourth Series, 1870-1871.

In Elwes and Henry, *Trees of Great Britain and Ireland* (privately printed, MCMIX) vol. IV, p. 726, I find that mention is made of these overgrowths as being the result of root graft, and in a foot-note (No. 3) reference is given to Mathieu, *Flore Forestière*, 529 (1897).

W. Dallimore, in his article "Natural Grafting of Branches and Roots", in *Kew Bulletin*, Nos. 9 and 10 (1917), p. 305, quotes the German authority, Sorauer, (*Handbuch der Pflanzenkrankheiten*, Berlin, 3rd Ed. 1909, Vol. 1, p. 774). From perusal of a translation of a transcript from Sorauer (kindly obtained for me by Mr. G. B. Sudworth, dendrologist, U. S.

A.), it appears that the German authority refers to a general opinion that the material contained in the stump prior to felling might be the only source of the new formations, and that they might also be due to root-graft between the stump and a tree possessing its crown; but he instances absolutely isolated stumps in which he avers the reserve material would not be sufficient explanation of the bulky formations which take place. He refers, in this connection, to the chlorophyll to be found in the rims of the overgrowth and says there is no reason why this chlorophyll apparatus should not assimilate as well as

the green bark of the trunk.

It appears then that European views of the cause of the overgrowth have differed. While the overgrowth is conceded on one hand to be a consequence of root-graft there are authorities who think it might be initiated by reserve material, and in the case of isolated stumps that the chlorophyll in the rims of the overgrowth might fulfil the functions of foliage. No particulars are given, so far as I can learn, of the steps which were taken to establish that the remote stumps were absolutely isolated.

On this continent Prof. Willis Linn Jepson appears to be the first to publish any



Fig. 1: Douglas fir, *Pseudotsuga taxifolia* (Poir.) Britt. Completely capped-over Douglas fir stumps—living posts—the vitality and capping-over being due to root union with foster-tree to the right. Locality, Admiral's Road, Esquimalt district, Vancouver Island.

reference to the characteristic of the healing and overgrowth of stumps. In *The Trees of California* (Cunningham, Curtis and Welch, San Francisco, 1909) p. 33, speaking of the second-growth circles of the Redwood, Prof. Jepson refers to the overgrowth of Douglas Fir stumps and says "the cause of this phenomenon is due, undoubtedly, to natural rootgrafting."

In the *Scientific American*, Vol. CVIII, No. 5, p. 112 (1913), continuity in vitality

and healings and overgrowth of stumps of Cuban Pine (*Pinus heterophylla*), Long Leaf Pine (*Pinus palustris*), and of stumps of Douglas Fir, (*Pseudotsuga taxifolia*) and Redwood (*Sequoia gigantea*) are spoken of as being a puzzle to the forester, and the statement is made that it would seem reasonable to conclude that these stumps are parasitic and that their roots are grafted to those of neighbouring trees.

In the article "Natural Grafting of Con-



Fig. 2: Bigtree, *Sequoia washingtoniana* (Winkl.) Sudworth. Completely capped-over stump of a California Bigtree, from the collection of the U. S. Forestry, Washington, D. C. Published by the courtesy of Mr. G. B. Sudworth, Dendrologist, U. S. Forestry, Washington, D. C.

ifers", *Proceedings of the Society of American Foresters*, Vol. XI, No. 4, (October 1916) p. 394, Prof. Harold S. Newins, Associate Professor of Forestry, Oregon Agricultural College, calls these stumps "Growing Stumps", and refers to the fact that they may be found growing vigorously and yet isolated as far as 20 feet from any growing tree (I have found them 50 feet). He says: "When found so isolated, the common belief has been that they subsist by drawing on a reserve supply of food materials which have been stored within their bodies and roots." He finally says that such "Growing Stumps" are the result of conjunctive symbiosis, which is made possible by their root-graft with a living tree. The two investigators on the Pacific Coast have therefore no hesitation in ascribing the cause of the overgrowth to natural graftage of roots with growing trees of the same species.

When, some years ago, I learned that the root-graft theory of the cause of the vitality and overgrowth of the stumps was doubted, I went to considerable expense in having doubtful-looking cases tested by excavation of the roots and in every instance the root-graft was established. It seemed that a very slight graft was sufficient, and that the host tree need not be very large to accomplish the overgrowth of a stump of a tree of greater size. I found it difficult to discover a stump very remote from other trees. The scattered large Douglas Fir of the original parklands of the vicinity were mostly still standing and the young growth was generally in dense formation. There was one instance in which a group of nine capped-over Douglas Fir stumps were distant over fifty feet from a large tree and there was absolutely no indication of roots of the stumps and tree being anywhere near each other; nevertheless, excavation proved that actual root-graft existed. The roots of the big tree stretched at a depth of two feet below the surface past the group of smaller trees, the tap roots of some of which had become grafted to the underlying roots of the big tree. These stumps, so grafted, were in turn root-grafted to others more remote and all were overgrown alike. This, I think, shows that apparently remote stumps

may really be root-grafted to growing trees by a series of concealed, unsuspected root-grafts. The more especially may this be so as frequently the major parts of the stumps are decayed and portions of roots only remain vital. This phase of the question, in my opinion, explains how remote and apparently isolated stumps can show bulky overgrowth. There is probably a chain of root-grafts connecting the stump with living trees. I have never been able to learn of an overgrown stump proved, by actual and complete excavation of all its roots and rootlets, to have no direct or indirect root-graft with foliage-possessing trees. The great spread of the lateral roots of conifers may not always be realized, and this, combined with indirect root-grafts, may enable overgrown stumps to have a source of elaborated food in a distant forest. In fact, it is hard to say whether the translocation of elaborated sap would ever stop as long as there were living stumps and direct and indirect root-graft with sufficient canopy of foliage. The question could be easily settled experimentally, as well as the point whether one species is more potent in this respect than another. The grafting together of the roots of separate trees should be of easy accomplishment artificially in a single season, and then, if the stems of those trees intended to be used for tests were cut the following year, an immediate overgrowth should commence in species prone to show the characteristic. The stumps in some species of conifers are said to respond more quickly than others. I have observed the phenomenon in Douglas Fir (*Pseudotsuga taxifolia*, (Poir.) Britt.) and in Grand Fir (*Abies grandis*, Lindley) only, the Douglas Fir being far more potent in overgrowth than the Grand Fir. In both species, when the overgrowth is cut off, a renewed healing takes place. I have never, however, seen a healing and overgrowth by means of secondary or indirect root-graft in the Grand Fir. Stumps showing healing and overgrowth abound in all districts in the vicinity of Victoria. In the Douglas Fir the heartwood of the stump is usually charged with resin and a complete capping takes place. In the Grand Fir the heartwood nearly always decays and a rim only of live wood ensues. The

Douglas and Grand Firs are the only two trees which I have had the opportunity of studying. The characteristic seems to obtain in all conifers where root union has taken place. Doubtless it would not occur in conifers which possess the power of stump sprouting, such as the California Redwood (*Sequoia sempervirens*, (Lamb) Endlicher). The Bigtree (*Sequoia washingtoniana* (Winsl.) Sudworth), on the

other hand, cannot sprout but shows the overgrowth characteristic in a very marked degree.

The question of the frequency of natural graftage as well as the extent to which it takes place among the trees in a forest is necessarily pertinent to the consideration of the question of overgrowth. Inarching of roots of a single tree is a well-known phenomenon. Whether wholesale inter-



Fig. 3: Douglas Fir. Partial overgrowth of stump (to the right) due to natural graft of its roots with those of a foster Douglas fir (to the left) The graft has developed into a bar of wood connecting the tree and stump. The ring of annual increment of the living tree on the left is seen to be enveloping the stump on the right. The centre of the stump, not being preserved by resin, is decaying and would have become one of the hollow stump types in which there is a rim of live wood only. Locality, Sylvan Lane, Gonzales Hill, Victoria, B. C.

grafting among the roots of similar species in the forests takes place always or does not do so, seems to be unknown. As destruction of primeval forests has, in land clearing operations, been taking place all over the country for a great length of time, one might expect that agricultural and forestry works would cover this point. Such, so far as I can learn, is not the case. The extensive root grafting of some conifers on the Pacific Coast has, however, forced itself on the attention of foresters and others. It has been noted in Douglas Fir and in Western Hemlock (*Tsuga hetero-*

phylla (Raf.) Sargent). Mr. W. R. Carter, Assistant Biologist, British Columbia Provincial Museum, Victoria, B. C., has informed me that on some of the coastal areas of the West Coast of Vancouver Island, wind, or other erosion, has disclosed continuity in root systems of Western Hemlock and other coniferous trees. This continuity of roots is often exposed to view for three or four hundred yards at a time. Others have spoken of the root-graftage of the hemlock impeding land-clearing operations. There does not appear to be any record whether the Hemlock root or stump



Fig. 4: Douglas fir stumps completely capped over by root-union with a foster tree. The roots from the foster tree are seen stretching through the centre of the group of stumps, some of which were united by graftage of their tap roots with the underlying roots from the big tree. The stumps on the outside of the group had no direct root graft with the foliage-possessing tree, but only indirect graft with those which had. Locality, Goldstream Road, Colwood, Esquimalt district, Vancouver Island, B. C.

sprouts or whether it has the overgrowth tendency. (It would be interesting to learn what the effect of this extensive continuity of root systems had on the stabilizing of the trees in the gale of last winter (Jan. 1921) which did such extensive damage uprooting valuable coniferous timber on the coasts of British Columbia, Washington and Oregon). At Rouvray, in France, while with the Canadian Forestry Corps, I particularly noted that the graftage of the roots of the Pines (*Sylvestris*, I think), was very noticeable. (Strangely enough, in one case where the bases of the stems of three pines were united and one tree had been felled some time previously, the stump showed no signs of vitality or overgrowth.) On the other hand I have seen the roots of coniferous trees intermingle without apparent graftage ensuing, and one often finds the stump of one Douglas Fir tightly pressed against the stem of a growing tree but no sign of vitality or overgrowth in the stump. From this I judge that contact and pressure will not always be followed by graftage. The cause of natural graftage of roots was considered by Mr. Dallimore to be mainly pressure, and Prof. Newins assigns the cause to pressure and affinity of species combined with other physical factors. In Elwes and Henry the fact that the bark remains alive to an advanced age is said to be for the vitality and consequent overgrowth of stumps of Silver Fir.

The feasibility of utilization of the wondrous creative biological power shown in the continuity of vitality and healing-over of these stumps of coniferous trees does not seem to have ever been contemplated in horticulture or silviculture.

Living fence posts can be grown, for they do naturally grow, and it should be easy to ensure the graftage of roots artificially. Metal or concrete caps fashioned for ornament or use could be placed on the stumps when cut and these would readily become enveloped by the overgrowth. These posts would last forever. Prof. Newins mentions an instance of an overgrowth having 200 rings, and at Stanley Park, Vancouver City, — close to the "Seven Sisters" — there is a capped-over Douglas Fir stump which must be nine or ten feet high. The foster-tree could be renewed from time to time if it became too bulky.

It is certain that trees retaining foliage canopy can, by direct root-graft and also apparently by indirect root-graft, transmit elaborated sap to remote stumps. The converse might be equally true, and the roots of stumps in moist rich soil might, by root graft, be able to maintain trees in places of drought and paucity of soil.

As ordinary grafting is said to be readily accomplished in conifers the retention of vitality by the stumps and roots might be practically turned to account in silviculture and in forestry, and rotation similar to coppice culture attained by grafting sturdy leaders of felled trees on the living stumps or roots. This might be especially useful in selecting cuttings in protection forests or parklands.

I feel convinced that the phenomenon of the root-graft and overgrowth of stumps of conifers is well worthy of greater study and experimental investigation than has been given to it.



THE LARGER FRESHWATER-CRUSTACEA FROM CANADA AND ALASKA.

By FRITS JOHANSEN.

(Continued from Vol. XXXV, p. 47.)

III—C. CLAM-SHRIMPS.

This suborder (Conchostraca) is easily distinguished from the two preceding ones by the presence of a double shell enclosing the animal completely (except when swimming) and attached to it dorsally, so that it can be opened and closed like a clam (see p. 45). Conforming with this the body is much compressed, but shows a distinct head-part, sometimes beak-shaped (rostrum) and protruding from the shell. The eyes are sessile and more like those of the "water-fleas" (Cladocera) than those of the fairy-shrimps. In other features also they resemble the Cladocera, and may be considered to stand half way between this group of animals and the Phyllopods. Thus the first pair of antennae are minute, but the second pair developed into long and powerful swimming organs. Of mouth-organs both mandibles and two pairs of maxillae are present; and the short, clumsy body is supplied with from 1 to 2 dozen pairs of foliaceous legs, subdivided both for respiratory and swimming purposes; they also support the female egg-mass dorsally, while the first pair serve with the male as clasping organs ("hand" and "claw"). The posterior body segments have each a pair of spines often present also on the compressed, large, terminal end (telson), which ends in a pair of filaments (cercopods). In size these animals are from a few millimeters to about 2 centimeters long, the *Estheriidae* being the largest forms.

Different from the Cladocera (where the young ones when emerging are very much like the adults) the clam-shrimps hatch as nauplii not unlike those of the fairy-shrimps, though the first pair of antennae are not yet out and the labrum much larger. But the other characters (enormous second pair of antennae and mandibular palps, single, median eye, pear-shaped body with little differentiation of the segments, etc.), are the same as with the other Phyllopods; also (as is the case

with the Notostraca-nauplii) the carapace is not yet developed. Gradually it assumes the shape of the adults by the outgrowth of the shell (carapace) on both sides behind the mouthparts, the shortening of the body, reduction of the mandibular-palps, and development of the paired eyes, foliaceous legs, etc., and sexual characters. It should be remembered, however, that of many clam-shrimps the larval stages are very imperfectly known or not known at all.

Their food consists of still smaller invertebrates (Entomostraca, Protozoa, etc.), which they secure by busily swimming around in circles in the water; as a matter of fact when observing them they seem never to be at rest. Their occurrence is extremely puzzling;¹ a water-hole a few feet wide may be teeming with them, whether it is situated in the woods, in a grassy swamp, or on open, dry plains²; on the other hand they may be entirely absent from other pools, ponds or lakes in the same place. As is the case with the fairy-shrimps they seem mainly to occur (around Ottawa) in pools or canals left by the overflow of rivers,³ and are found from April to the time the pools dry up (July). In the summer the females carry their eggs around with them; they are deposited then before the pool they are found in dries up or freezes to the bottom. The females have also (Packard, Sars) been noticed to carry their eggs in the spring (see below).

It is interesting that so far there are no records of them from the high Arctic (except Siberia), though, as mentioned, both fairy-shrimps, tadpole-shrimps and water-fleas have their typical representatives up there. I did not find them on the Canadian Arctic Expedition, nor are they known from Greenland. My identifications of the Conchostraca from the new Can-

¹ Some years they do not show up at all.

² The genus *Limnetis* seems to prefer pools with much vegetation.

³ Or holes filled with water by heavy rains.

adian localities given on the following pages have been verified by Professor A. S. Pearse, of the University of Wisconsin.

Canadian "clam-shrimps" were first described in 1862 by W. Baird from specimens (*Limnetis gouldii*) collected by Ch. Gould in June 1857 at St. Anns, Montreal, P.Q., and from specimens (*Estheria caldwelli*) collected by W. Caldwell in Lake Winnipeg, Man. They are represented upon this continent by three families (sub-families); the Limnetidae, Limnadiidae and Estheriidae, the two last families being often united by authors. The first family is easily distinguished from the two others by the milky colored shell being more or less spherical and with lines of growth, and the head cannot be retracted into it. In these characters the family reminds one strongly of the Cladocera, especially the family Lynceidae, though the clam-shrimps do not possess the huge claw-foot of these Cladocera. Only one genus (*Limnetis*, established by Loven in 1845) belonging to this family of clam-shrimps occurs in North America, but it is represented by four species of which three are known only from the United States (*L. mucronatus* occurs in Montana), but one (*L. gouldii* Baird) also in Canada. This latter species is rather hardy and easy to keep in an aquarium; the eggs are found under the back of the shell of the female in the spring and early summer (May-July), according to Packard. It has been recorded from New Hampshire, Massachusetts, Rhode Island, New York and Illinois; from Canada I have before me specimens from the following localities, arranged from east to west:—

About two dozen specimens from a wood beyond Montreal West, P.Q., June 17, 1917, A. Willey, coll. (sent to me from McGill Museum).

Many specimens (the smaller ones reddish, the larger ones, some of which are egg-bearing females, yellow-green⁴ collected by myself in a ditch-canal left by the overflow of the Ottawa River on the fields a little east of Gatineau Point, P.Q., June 14, 1919. When I visited this place again on October 19 of the same year the ditch was completely dried up, being filled with

Carex and much other vegetation; no clam-shrimps were of course observed on that occasion.

On April 18 and May 30, 1920, I again visited the same ditch; but as the water-level of the Ottawa River this year was (even at its maximum) much lower than in 1919, there was no connection between the river and the ditch. The latter had very little water left, merely small holes which contained only some aquatic molluscs, insects, tadpoles, and the Isopod *Asellus communis*. The farmer who owned the field upon which the ditch was situated had ploughed it up and partly filled in the ditch, so the latter will probably never again contain any "clam-shrimps."

On May 2nd, 1921, I collected a number of immature (1½ to 2 cm. long) specimens of this species, in a fairly large and deep pond on a field on the hills at Tenaga, west side of Gatineau River, P.Q. They had a vivid orange or red-brown colour, and were easy to catch as they were swimming slowly ("suspended") in the water, or attaching themselves to plants. They occurred in great numbers, together with Cladocera, Ostracoda, and the fairy-shrimp, *Eubrachippus gelidus*, etc. At the end of May neither fairy-shrimps nor Conchostraea were to be found in this pond.

Mr. W. S. Odell, of Ottawa, tells me that about a dozen years ago he secured many of these clam-shrimps in a pool on the fields at Wychwood (near Aylmer), P. Q., and that he secured more in the same place during the succeeding years (in May). When I visited this pool on May 15, 1921, it was quite dried up, and furthermore used as a dump for rubbish, so that it probably contains no more crustacea. Mr. Odell also secured them in pools alongside the railway-track near Hurdman's Bridge (Rideau River) about a dozen years ago; but for several years their habitat there has been destroyed. Furthermore, for several years Mr. Odell has observed them in the pools left by the overflow (in the spring) of the Rideau River on a pasture at Billings Bridge, Ottawa South, near the brick-yard; and he showed me some he had collected there, together with the fairy-shrimps *Eubrachippus gelidus* of both sexes, on the first week of May, 1921. A week later he and I visited the place, but did not succeed in finding a single fairy-shrimp, though the

⁴ Baird describes his specimens, which were 3 x 3 mm. long, as having a pale fleshy-yellowish color, with black eyes.

clam-shrimps, cladocera, ostracods and copepods occurred in great numbers. The *Limnetis* were conspicuous by their orange colour, and both sexes were seen, often in copulation; some of the females had already (May 16) their olive-coloured eggs shining through the shell. The pools in which they occurred I found to be the deeper holes left in the bed of the ditch-canal, much overgrown with water-plants, and with many dead leaves in the bottom from the large oak-trees scattered over the pasture.

The place was visited repeatedly, and all during May the clam-shrimps were found in the larger ponds not yet dried up completely. After a time the red colour of the full-grown individuals changes from orange to brownish, and the egg-bearing females seem to be more numerous than the males, the latter probably dying off rapidly when their function is finished. The two sexes were often seen in copulation, during which process they seem unable to float in the water, but are crawling over the bottom-mud or lying there. By keeping them in a glass of water I observed how during the act the female eventually closes its shell, and the male has all it can do to keep them both free of the bottom. It is a very funny sight: the male moving all its feet vigorously, trying to rise in the water, but the female having the effect of a sinker attached to him, so that the net result is to cause them both to roll over, wrestler-fashion, owing to the globular shape of the body. Sometimes two males would attack one female, but probably this was because so many were crowded together in the bottle.

From June on their numbers decreased markedly; and at the end of the month none were found (the last ones were secured on June 19, when the two sexes were still observed in copulation. Several of these, the last survivors, had a growth of minute, green Algae, etc., upon their shells, a sign of decay). Around Ottawa their life thus seems to last two months. It will be seen, however, from the record of these clam-shrimps from Saskatchewan, given below, that where suitable surroundings are found they may occur also later in the summer.

The weather during April, May and June, 1921, around Ottawa, was very

warm, and with practically no rain; it was interesting to observe, that when a period of unusually hot weather arrived in the first half of May, the fairy-shrimps (*Eubbranchipus gelidus*) were not to be found any more. I ascertained this by visiting the various pools in which I had found them so common only a few weeks before.

About one dozen specimens from a water-hole on the margin of a wood at Scarborough Junction near Toronto, Ontario, June, 1908, A. G. Huntsman coll. (see *Natural History of Toronto Region*, 1913, p. 275).

Three specimens from pond at Estevan, Sask., August 3, 1916, W. R. Quinn, coll. (sent me from Royal Ontario Museum).

Four specimens, the two largest of which were egg-bearing females, from a slough three miles north-east of Medicine Hat, Alta., June 11, 1920, A. G. Huntsman coll. They occurred together with *Estheria caldwelli*, *Streptocephalus coloradensis* and *Lepidurus coesii*.

One full-grown and three young specimens from a shallow slough at Wetaskiwin (near Edmonton), Alta., June 1, 1920, A. G. Huntsman coll. The fairy-shrimp *Eubbranchipus gelidus* was collected in the same slough.

It thus seems as if this species is not found in the Rocky Mountains, nor west of them. It has not been recorded from Alaska, nor did I find it along the arctic coast of this continent west of Bathurst Inlet (Canadian Arctic Expedition).

In size this species does not exceed half a centimeter in length, the females generally being the largest.

Another species (*L. brachyurus*) is known from Scandinavia, Central Europe, Russia and Siberia, and is well described and figured by Sars (1896) p. 117, plates 18-20. He mentions particularly how he only succeeded in finding it in one ditch with much vegetation in Finmark, in August, though he examined carefully many others; he also observed how it swims with the shell-valves wide open, but often sinks to the bottom; and how the males firmly grab the valves of the females below by their "hands" for the purpose of copulation. Some of the larval stages are described by Grube.

To the second family of clam-shrimps belong two genera, *Limnadia* and *Eulimna-*

dia. The shell of the former genus (established by Broignard in 1820), is very broad-ovate, flat and with a great number (18) of lines of growth. So far only one species has been found upon this continent, namely *L. americana*, known from Massachusetts; it may therefore possibly occur also in eastern Canada. Sars (1896) thinks it is the same as *L. lenticularis* Linn. known from Scandinavia and Central Europe; he describes and figures this on p. 85, plates 14-16, and the larval stages on plate 17. He says the females already carried the eggs at the end of July and that the larvae were found in the middle of the same month; he expresses the opinion, however, that only one brood is developed each summer. The size of *L. americana* is about 1 cm. The other genus (*Eulimnadia*) is represented upon this continent by two species of which one is known from Kansas, Nebraska and Texas, and the other, *E. agassizii*⁵ from Massachusetts and Ontario. The genus has a narrow ovate, very transparent shell with 4-5 lines of growth about 1-2 cm. long. I have before me four specimens of *E. agassizii* collected by A. G. Huntsman in pools on rocks at Go Home Bay (Georgian Bay) Ont., August 15th (1905), sent me from the Royal Ontario Museum (See *Natural History of Toronto Region*, 1913, p. 275).

Dr. Huntsman writes me (June 1920), that "this species occurred at two places at Go Home Bay, namely at Station Island and at Split Rock Island. In each case a large number of specimens was found in a small, temporary pool in the rock, the pool probably not being more than a foot or two feet in diameter, and quite shallow. It seemed extraordinary that so many individuals of relatively large size should occur in so little water..."

The third family of clam-shrimps (Estheriidae) is represented on this continent by the genus *Estheria* of which more than half a dozen species are known from the United States, but only one, *E. caldwelli* (*Cyzicus mexicana*)⁶ from Canada. It is interesting that no species of this genus has so far been found east of Saskatchewan

and the Mississippi River. The genus is easily recognized by the oval, more or less globose shell of an amber colour (thus much like a clam-shell) showing about 20 lines of growth until about 1½ cm. long. I have before me five specimens of *E. caldwelli* from a prairie-slough at Estevan, Sask., collected by W. R. Quinn on August 6th, 1916, and sent me from the Royal Ontario Museum. The species was first described in 1862 by W. Baird from specimens collected by W. Caldwell in Lake Winnipeg, and two years earlier by C. Claus from Mexico; it has further been recorded from Kansas, Nebraska, Kentucky, Ohio and New Mexico.

I have recently received one more specimen collected by Dr. A. G. Huntsman on June 11, 1920, in a slough three miles north-east of Medicine Hat, Alta., where it occurred together with *Limnatis gouldii* and other Entomostraca. The specimen is about 9 mm. long, while some of the five specimens from Estevan, Sask., mentioned above were almost double this size.

Clam-shrimps were recorded from Finland by Linnaeus; but the order was well-described for the first time by Herman in the beginning of the nineteenth century.

POSTSCRIPT.

In June, 1920, I received a letter from Dr. Chancey Juday, of Madison, Wisconsin, giving me some new records of clam-shrimps collected by J. M. Jessup in May-July, 1911 and in July, 1912, in Alaska and Yukon Territory.

As these are the first records of Conchostraca from the arctic and subarctic parts of this continent, and the first time the two species in question have been found in America, it is of importance to have them included in this article. The records are:

Lyneus brachyurus (*Limnatis* b.):—Lakes and bog-holes on Old Crow River flat about 40 miles north of New Rampart House; Lake 48 miles north of New Rampart House; Morainal lakes, 30-35 miles north of White Horse, Yukon Territory.

Limnadia lenticularis:—Lakes on coastal

⁵ First described (and the genus established) by Packard in 1874, from specimens collected by W. Faxon in Massachusetts in 1873; the females had then (August) yellowish eggs. The following July-August the young ones were about 1 line in length.

⁶ The genus-name *Estheria* was made by Rueppell, in 1857, but later the genus was found to be the same as Audouin's *Cyzicus*, established in 1837. Similarly Baird's species *E. caldwelli*, described in 1862, has been proved to be the same as *C. mexicanus*, first described by Claus two years previously.

plain of Arctic Ocean (about 69° 40' N., 141° W.); isolated pond off Old Crow River.

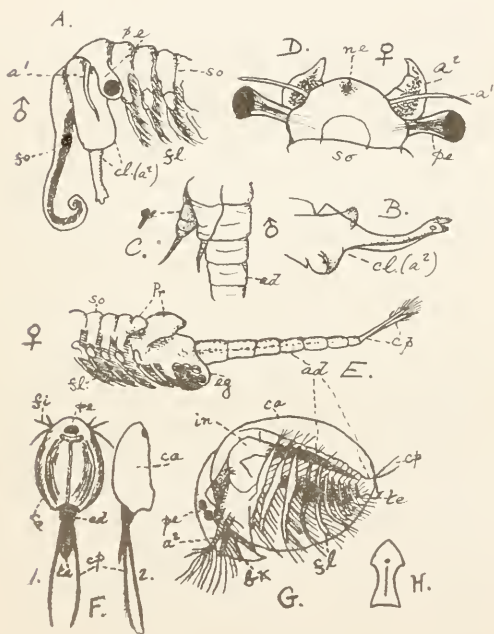
Both of these species have been already mentioned in this article.

Note.—I have been unable to find any popular, English names for Notostraca and Conchostraca, and am therefore in these articles proposing the names of "tadpole-shrimps" and "clam-shrimps" for them. To distinguish the "clam-shrimps" from the Ostracoda I propose for the latter the name of "mussel-shrimps"; a translation of the popular, Danish name for the Ostracoda. The difference in the shape of the shell between the Conchostraca and the Ostracoda is thus indicated in these popular names. The popular Danish name for

Notostraca (Apodidae) means "pond-ray"; but I think it better to use a popular English name for them which indicates the class of animals to which they belong.

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A-E: *Eubbranchipus gelidus* Hay; F: *Lepidurus couesii* Pack; G-H: *Limnetis gouldii* Baird. Above letters explained: fo: frontal organ; a¹ first pair of antennae; a² (cl): 2nd pair of antennae (or claspers); ne: nauplius-eye; pe: paired eyes; fi: filaments of 1st pair of feet; so: bodysegments (somites); fl: foliaceous legs; ca: carapace (or shell); bk: beak of head; in: intestine; pr: processes from somites; eg: eggsack with eggs; ge: male genitalia; ad: abdomen; te: telson; cp: cercopods. (A and E, after Pearse; F-H, after Packard; B-D, Originals.) A, C, E, F², G are lateral views; D and F¹: dorsal views; B: clasper from inside; H: front view of head.

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- (Concluded.)

NOTES ON THE FAUNA OF LOWER PAGWACHUAN, LOWER KENOGAMI AND LOWER ALBANY RIVERS OF ONTARIO.

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The following observations were made between July 25th and September 16th, 1920, while on a geological trip along the river route between Pagwa on the National Transcontinental railway and Fort Albany on James Bay. A side trip was also made 25 miles up Albany River from the Forks. The route is along rivers of the Albany system and falls into three main divisions,—the Pagwachuan River, estimated distance 35 miles; the Kenogami River from the mouth of the Pagwachuan River to the Forks of the Albany River, estimated distance 85 miles; the lower Albany River

from the Forks to James Bay, estimated distance 150 miles. English River post, formerly known as Mammawemattawa, occupied by traders of the Hudson's Bay and Revillon Frères fur companies, is about 25 miles below the mouth of the Pagwachuan River and at the junction of the Kabinakagami and Kenogami Rivers. The Naga-gami River enters the Kenogami about one mile higher up. Both fur companies mentioned have posts at the mouth of Chipie (Ghost) River about 50 miles below the Forks of the Albany, and the Hudson's Bay, the Revillon Frères and the James

Bay Company have posts at Fort Albany, the last recently established; a large Roman Catholic mission is also situated there. The estuary of the Albany River is about 16 miles long and is composed of many islands, the largest, Albany Island, being about seven or eight miles long and about one-half as wide. Near the middle of the south side of this island the settlements are established. Tide water extends to the head of Albany Island.

The river flows across a plain which slopes toward James Bay at less than two feet per mile. For about ten miles below the steel, the Pagwachuan flows through boulder clay overlain by silts and sand, the latter rising into hills and ridges. For this distance the bedrock is pre-Cambrian in age and is seen by outcrops of grey granite in the river bed. To the north the crystalline rocks are overlain by Palaeozoic limestones and shales, and across this sedimentary basin, the country, as seen from the rivers, is a monotonous muskeg dotted with stunted black spruce. The floor is of sphagnum moss, laurel and Labrador tea. The river valleys give variety in vegetation and topography, their terraces being commonly covered with fair stands of white spruce, white birch, white and balsam poplar, and scattered cedar, tamarack, ash and jackpine. Isolated stands of ash and elm occur at the junction of the Kabinakagami and Kenogami rivers, and on the latter river near the mouth of Little Current River. Red osier dogwood and willow grow along the river flats.

BIRDS.

Loon, *Gavia immer*. Two seen in the estuary of the Albany River, August 18th.

Herring Gull, *Larus argentatus*. One seen at mouth of Pagwachuan River, August 5th. Two immatures seen at Forks of Albany, August 12th. Several seen each day between the Forks and the estuary of the Albany, August 13th—August 18th. On lower Albany adult birds seen August 24th, 27th and Sept. 1st. Immature birds seen August 18th, 25th, 28th, 31st, Sept. 5th and one at the mouth of the Pagwachuan, September 13th.

Common Tern, *Sterna hirundo*. Several seen in the Albany estuary, August 18th

and 24th. Several were seen at Fishing Creek Island¹, August 26th.

American Merganser, *Mergus americanus*. Birds probably of this species were observed as follows:—two at mouth of Pagwachuan River, August 5th; a flock, at Fort Albany, August 20th; eight at Hat Island², August 31st.

Mallard, *Anas boschas*. Five seen in the hands of Indian hunters, at Albany, August 21st. They were killed along the coast to the west of the river.

Black duck, *Anas obscura*. One seen in Albany estuary, August 18th; several seen in the hands of Indian hunters at Fort Albany, August 20th.

Golden-eye, *Clangula clangula*. Two seen at mouth of Pagwachuan River, August 5th; five ducks probably of this species near Snake Island³, August 14th.

Canada Goose, *Branta canadensis*. Seen as follows:—At Fishing Creek Island, Albany River, five seen on August 17th; in estuary of Albany, twelve seen on August 18th and again on 19th; a flock seen at Fort Albany, August 21st; twelve in the estuary, August 26th; twelve at the mouth of Ghost (Chipie) River⁴, August 30th; twelve at Hat Island, August 31st; a flock 20 miles up the Albany from Forks, Sept. 3rd.

Wilson Snipe, *Gallinago delicata*. One seen at the Forks of the Albany, Sept. 2nd, and one about 30 miles above the Forks, September 5th.

Semipalmated Sandpiper, *Ereunetes pusillus*. Birds probably of this species seen as follows:—August 1st, two near mouth of Pagwachuan River; flocks near the mouth of Chipie River, August 14th, 15th and 16th; their notes heard at the Forks of the Albany, Sept. 4th and 5th.

Greater Yellow-legs, *Totanus melanoleucus*. Generally common from the mouth of the Pagwachuan River to Fort Albany between August 3rd and September 6th, after which none were observed. Two old birds flew back and forth past our camp at the mouth of the Pagwachuan, August

¹ About 50 miles up the Albany.

² About 35 miles below the Forks of the Albany River.

³ About 16 miles below the Forks of the Albany River.

⁴ 50 miles below Forks.

3rd to 5th, screaming and apparently trying to lure us away from their young, which appeared to be running about on the gravel bars at the far side of the river. Two were taken at Snake Island on August 13th.

Solitary Sandpiper, *Helodromas solitarius*. Two birds probably of this species seen 10 miles below railway on Pagwachuan River.

Spotted Sandpiper, *Actites macularia*. Common throughout trip.

Semipalmated Plover, *Egialitis semipalmata*. One seen near Chipie River, August 16th; several seen at Forks of Albany, September 2nd.

Ruffed Grouse, *Bonasa umbellus*. One seen at the Forks, Sept. 2nd., and one at Pagwa, Sept. 16th.

Marsh Hawk, *Circus hudsonius*. Nine seen between Snake Island and the estuary of the Albany River, August 14th-26th. Two seen at the Forks, Sept. 2nd, and two thirty miles up the Kenogami, Sept. 6th.

Cooper's Hawk, *Accipiter cooperi*. One seen at Albany estuary, August 25th, and one at Fishing Creek, August 27th.

American Goshawk, *Accipiter atricapillus*. One female shot 30 miles above Forks on Kenogami River, Sept. 5th. Three seen between this point and English River post, Sept. 5th.

Red-tailed Hawk, *Buteo borealis*. Seen as follows:—Five on Kenogami River below English River post, August 11th; one at estuary of Albany, August 24th; one at Sand Cherry Island⁵, August 27th; four at the Forks, Sept. 2nd; two twenty miles above Forks on Albany River, August 3rd; two on Kenogami River, 30 miles above English River post, Sept. 6th; one on Kenogami River, 17 miles above English River post, Sept. 10th; one at the mouth of Pagwachuan, Sept. 13th, and one near Pagwa, Sept. 15th.

Broad-winged Hawk, *Buteo platypterus*. One seen about six miles above mouth of Pagwachuan River, July 31st.

Pigeon Hawk, *Falco columbarius*. Two seen at Hat Island, Albany River, August 31st, and two, on Sept. 3rd, 20 miles above Forks on Albany River.

Sparrow Hawk, *Falco sparverius*. One

seen at Pagwachuan River, July 29th; two seen at Snake Island, Albany River, August 14th.

American Osprey, *Pandion haliaetus carolineus*. One seen at estuary of Albany, August 18th and again August 25th. Five seen at Henley River six miles below the Forks, Sept. 1st; two seen on the Albany River a few miles above the Forks, a female being collected; one seen at the Forks, Sept. 5th.

Short-eared Owl, *Asio accipitrinus*. Very common every evening spent at Fort Albany. Six seen August 19th, ten on the 21st, two being collected.

Great Horned Owl, *Bubo virginianus*. One heard July 30th on Pagwachuan River. One seen on same river July 31st. One heard at Hat Island, August 31st.

Belted Kingfisher, *Ceryle alcyon*. Seen occasionally as far down as the head of the estuary of the Albany, 20 birds being counted in all.

Hairy Woodpecker, *Dryobates villosus*. One seen on Pagwachuan River, July 30th; two seen on Hat Island, August 31st; one heard at English River post, Sept. 7th.

Arctic Three-toed Woodpecker, *Picoides arcticus*. One seen 20 miles above the Forks on Albany River, Sept. 3rd.

American Three-toed Woodpecker, *Picoides americanus*. One seen at head of Albany estuary, August 19th, and at Fort Albany, August 21st.

Flicker, *Colaptes auratus*. One seen near mouth of Pagwachuan River, August 1st; one heard at English River post, August 9th, and one seen August 10th; two seen at Forks of Albany, August 13th; one seen on Pagwachuan River on Sept. 14th and one on 15th.

Night Hawk, *Chordeiles virginianus*. Fairly common on Kenogami river between the mouth of the Pagwachuan River and the Forks of the Albany from August 3rd to 12th; one seen at the head of the Albany estuary, August 18th.

Olive-sided Flycatcher, *Nuttallornis borealis*. Heard on August 8th and 10th at English River post, and one seen there August 9th.

Horned Lark, *Otocoris alpestris*. One seen at Fort Albany, August 21st; thirty seen on Albany River 20 miles above the

⁵ 75 miles above mouth of Albany.

Forks, September 3rd; five seen at mouth of Pagwachuan River, Sept. 13th.

Canada Jay, *Perisoreus canadensis*. Heard on Pagwachuan River, July 26th and 27th; common throughout rest of trip.

Raven, *Corvus corax*. Noted as follows: Two at English River post, August 10th; a flock at Fishing Creek Island, August 16th; two at estuary of Albany, August 18th; on return trip five single birds were seen between Hat Island and 17 miles above English River post on the Kenogami River, August 31st to September 10th.

Red-winged Blackbird, *Agelaius phoeniceus*. One immature male taken 20 miles above English river post, Sept. 9th.

Rusty Blackbird, *Euphagus carolinus*. Two seen on Pagwachuan river, August 30th; a flock seen at the Forks of the Albany, September 2nd; eight seen on the Pagwachuan, Sept. 15th.

White-winged Crossbill, *Loxia leucoptera*. The commonest bird seen on the trip July 25th to Sept. 16th, and their twittering flight song was heard every day between the steel and Fort Albany. Three males were taken at Pagwa, July 28th.

American Goldfinch, *Astragalinus tristis*. Birds probably of this species seen at the Forks and at Fishing Creek Island, August 12th and 17th.

White-throated Sparrow, *Zonotrichia albicollis*. Heard at Fort Albany, August 23rd; common between the Forks and the mouth of the Pagwachuan River. September 2nd to 14th.

Junco, *Junco hyemalis*. Several seen at the Forks, Aug. 13th; several seen almost every day between Fort Albany and Pagwa, Aug. 22nd to Sept. 13th.

Song Sparrow, *Melospiza cinerea*. Several seen at mouth of Pagwachuan, August 5th; one at English River post, August 8th; two doubtfully of this species near English River post, Sept. 9th; several at the mouth of the Pagwachuan, Sept. 13th, and several 10 miles farther up, Sept. 15th.

Fox Sparrow, *Passerella iliaca*. One seen each day Aug. 20-23rd at Fort Albany.

Tree Swallow, *Iridoprocne bicolor*. Several seen at mouth of Pagwachuan, August 5th.

Cedar Waxwing, *Ampelis cedrorum*. Common along Pagwachuan from Pagwa to its mouth, July 25th to August 4th; one seen at English River post, August 9th, and one at estuary of Albany River, August 18th.

Black and White Warbler, *Mniotilta varia*. One seen at mouth of Pagwachuan, August 4th.

Oven Bird, *Seiurus aurocapillus*. One heard at mouth of Pagwachuan River, July 25th.

American Redstart, *Setophaga ruticilla*. Three seen at mouth of Pagwachuan River, August 4th.

American Pipit, *Anthus pennsylvanicus*. Common at the Forks of the Albany and 20 miles up both the Albany and the Kenogami, Sept. 1st to 5th. Several seen on Kenogami 10 to 20 miles above English River post, Sept. 10th.

Hudsonian chickadee, *Penthestes hudsonicus hudsonicus*. Heard at English River post, August 22nd; several seen at Noran Island⁶, August 29th; fairly common 20 miles up Albany from Forks and up Kenogami to mouth of Pagwachuan, Sept. 2nd-13th.

White-breasted Nuthatch, *Sitta carolinensis*. Note doubtfully identified at Fishing Creek, August 27th, and identified with certainty at the Forks, Sept. 2nd.

American Robin, *Planesticus migratorius*. One seen near mouth of Pagwachuan River, August 1st; one seen at Forks of Albany, August 21st.

MAMMALS.

Drummond's Vole, *Microtus drummondii* (Audubon and Bachman). Taken at Fort Albany, August 23rd.

White-footed Mouse, *Peromyscus maniculatus maniculatus* (Wagner). Taken at Fort Albany, August 23rd.

Hudson Bay Jumping Mouse, *Zapus hudsonius hudsonius* (Zimmermann). At the mouth of the Pagwachuan River, August 4th.

Black Bear, *Ursus americanus americanus* Pallas. Fresh signs seen in Albany estuary, August 23rd.

Grey Wolf, *Canis occidentalis* (Richard-

⁶ Noran Island is situated about four miles below Chipie River, 54 miles below the Forks of the Albany.

son). Two young wolves were held in captivity at the Catholic Mission at Fort Albany. A large grey animal accompanying two jet black ones appeared on the shore of Albany River about 12 miles above the Forks, Sept. 4th. The grey one appeared to be a wolf, the other two may have been Indian dogs, but pure black dogs are rare.

Northern Chipmunk, *Eutamias quadri-vittatus borealis* (Allen). Common from mouth of Pagwachuan River to English River post, August 5th to 9th.

Hudson Bay Squirrel, *Sciurus hudsonicus hudsonicus* (Erxleben). Common along whole route.

Muskrat, *Ondatra zibethica* (Linnaeus). Remains abandoned by Red-tailed Hawk (sp.?), as we approached, about 10 miles above Forks on Albany River, Sept. 3rd. One seen on the Kenogami River, Sept. 6th.

Northern Hare, *Lepus americanus americanus* Erxleben. Conspicuous by their absence. Some signs seen.

Moose, *Alces americanus* Jardine. Tracks commons along Pagwachuan River.

A calf passed close to our camp in the early morning on the Kenogami River a few miles below the mouth of the Pagwachuan River, August 5th. Saw a cow on Kenogami River about 15 miles below English River post, August 11th.

Virginia Deer, *Odocoileus americanus borealis* Miller. One reported shot on Pagwachuan River late in July. Indians had deer meat at Fishing Creek Island, August 17th.

BATRACHIANS.

American Toad, *Bufo lentiginosus*. Common along Kenogami and Albany Rivers as far as Fort Albany, August 6th to 31st.

FISH.

Lake Sturgeon, *Acipenser rubicundus*. Five taken in one net at mouth of Chipie River, August 14th. Reported very common here.

Sucker, *Moxostoma*, sp.? Two taken in our net at mouth of Chipie River, August 14th. These are the commonest fish along the rivers traversed.

NOTES AND OBSERVATIONS.

AN AQUATIC HABIT OF THE PIGEONS.

For a terrestrial bird to exhibit any aquatic habit, even though rarely, would seem to be of interest and perhaps may have an obscure significance.

Some twelve years ago, I think it was, on a very warm summer day, I was canoeing on Lake Ontario near Toronto Bay. About three domestic pigeons (*Columba livia*, var.?) circled once near me, lit gracefully on the calm surface of the lake, remained there for a few seconds during which time I believe they drank, and then rose easily and flew away toward the city.

Never having seen or heard of such a performance by pigeons, I was surprised to the point of incredulity. Mr. C. W. Nash was told of the incident and recollected seeing pigeons light on Ashbridge's Bay on one occasion. He believed at first that they had lit on floating weeds, but he decided later that the water was deep at the point in question.

Mr. R. L. Strothers reported to Mr. Nash that he had shot at an unknown bird as it rose from his trout-pond where it had alighted to drink, and was much surprised to find that he had killed a Carrier Pigeon, one of the races of the domestic pigeon.

Harting¹ mentions that Wood Pigeons (*Columba palumbus*) and domestic pigeons have this habit, and as he is one of the few observers who mention it the item is worth quoting.

"In very hot weather Wood Pigeons (as well as house pigeons) may be seen alighting occasionally on the surface of water to drink, and after a few seconds flying off again (*Field*, June 26 and July 3, 1875)."

So far as I am aware most writers on the Passenger Pigeon (*Ectopistes migratorius*) make no reference to this species

¹ Harting. *Handbook of British Birds*, p. 124.

drinking from the surface of the water. W. A. Linkletter¹ writing in *Rod and Gun* records some interesting notes which show that the Passenger Pigeon also drank from the surface of the water.

The apposite portion of his article is quoted below:

"I wish to mention several peculiarities which I deem no other variety of birds have. Having lived with them for thirty years I had an opportunity to learn things about them which few people ever enjoyed. And of the numerous articles which I have seen in print in regard to them, none of the writers mentioned any of the peculiar capers which the pigeons cut. Although they were not water-fowl, if there was no other way to get to the water they would alight on the water with their wings half spread and after drinking they would clear the water at one flap of the wings."

This observer notes an important point—the wings were "half spread", doubtless to keep them dry. His evidence is that this species also alighted on the surface and did not drink while hovering over it, for he says: "After drinking they would clear the water with one flap of the wings."

To sum up, the domestic pigeon (which is descended from the Rock Dove of Europe) and the Wood Pigeon of Europe, exhibit, and the Passenger Pigeon of North America exhibited, even if rarely, the habit of alighting upon water to drink.

Perhaps observation will show that many other species of the great Order Columbæ have similar habits.

The occurrence of this habit in the genera *Ectopistes* and *Columba* shows that it is wide-spread. Have these different species all acquired such a curious habit independently or has it an ancient foundation? Habits may be more or less transient and the habit of the pigeons under discussion is too rare to warrant specific conclusions, but it should not be forgotten that many groups of birds which are considered as related to the Pigeons are aquatic.

Pycraft² shows the following groups allied with the Pigeons in the Charadrii-

formes (Plover-like birds). The groups may be separated as follows:—

Terrestrial.

Turnix (European and Australian Quail),
Columbi (Pigeons), Pterocles (Sand Grouse).

Aquatic.

Thinocorys (Seed-Plovers), Glareoli (Cour-
sers), Chionis (Sheath-bills), Dromas
(Crab-Plovers), Alcidae (Auks), Lari
(Gulls), Oedienemidae (Stone-Curlews),
Charadrii (Plovers).

HOYES LLOYD.

FRESHWATER CRUSTACEA FROM CANADA.

Additional specimens of *Gammarus limnaeus* from British Columbia (see Vol. XXXIV, p. 130), have been received from Mr. and Mrs. T. L. Thacker, of Little Mountain, Hope, B. C. They comprise very young and half-grown individuals from the following localities:

Little Mountain, Hope, B. C., March-April, 1918.

Sucker Creek, Hope, B. C., July 30, 1921.

Nieomecal River, and two small creeks running into it, about one-half mile south of Langley Prairie Station, B. C., August 5, 1921.

In the article referred to above, p. 128, I stated that another amphipod, *Pontoporeia affinis*, had so far only been found in the sea. Dr. Chaceey Juday, of the University of Wisconsin, Madison, tells me in a letter that the species (identified by Prof. G. O. Sars of Christiania) is common in Green Lake, Wisconsin, and has been found also in certain lakes in New York State. Equally interesting is its occurrence in the deeper parts of certain large lakes in the Scandinavian countries (Denmark, Norway, Sweden), and in Russia, where it is generally considered (see e.g. Wesenberg-Lund, in *Kgl. Danske Videnskab. Selsk. Skrift.*, 1902 and 1917) a typical, glacial relict-form, in the same way as the schizopod, *Mysis relicta* Loven, also occurring there and in certain lakes upon this continent (see H. L. Schmitt, in *Rep. Can. Arctic Exped.* 1913-18, Vol. VII, Part B, p. 3). Some recent authors think it more probable that neither *Pontoporeia affinis* nor *Mysis relicta* are "rel-

¹ *Rod and Gun in Canada*, December, 1920, p. 754.

² *A History of Birds*, Chap. III, p. 41.

icts," but have immigrated to the lakes they now inhabit, at the end of the glacial period.

The records of *Pontoporeia affinis* from salt water include the north coast of Alaska (Canadian Bay), the Gulf of St. Lawrence, the North Atlantic south to France, besides the Kattegat, Baltic and Kara Seas (see *Rep. Can. Arctic Exped.*, Vol. VII, Part E, p. 10).

FRITS JOHANSEN.

ADDITIONAL SPECIES FOR THE LIST OF
COLDSTREAM BIRDS.

(Continued from Vol. XXXIV, p. 53.)

195. *Empidonax virescens*. — Acadian Flycatcher.

Took a male on May 26, 1921, being the first record for this country.

196. *Hesperiphona vespertina*. — Evening Grosbeak.

On Jan. 5, 1919, a flock of nine appeared here, some of which remained until the end of the month. Also located a flock of twenty-five which had roosted in spruce trees on a farmer's lawn for nearly two weeks. Several birds were noticed working around basswood seeds, but all stomachs examined contained only maple seeds.

197. *Bombycilla garrula*. — Bohemian Waxwing.

Secured two males here, Jan. 30, 1920. R. T. Hedley records a flock of sixteen on Feb. 3, a few miles south of here, and a large flock two miles east of Duncrief, the week before.

198. *Dendroica vigorsi*. — Pine Warbler.

Took a male June 9, 1920.

199. *Sciurus motacilla*. — Louisiana Water Thrush.

A male taken by W. R. Campbell, four miles west of Coldstream, June 2, 1913.

200. *Penthestes hudsonicus*. — Hudsonian Chickadee.

A male taken Oct. 31, 1919, and a female, Nov. 28. The only individuals noted here. Their notes and actions were very much slower than *atricapillus*.

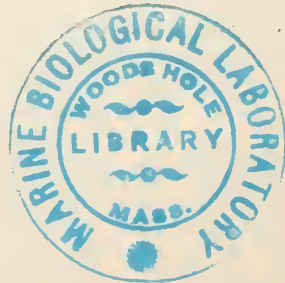
A. A. WOOD.

STARLING AT LONDON.

On the morning of May 15th, 1921, several members of our Bird Club motored to Port Stanley to spend a few hours with the birds. We found them very numerous and in the sheltered nooks the air was full of song. The principal item of interest was the finding of three Starlings along the lake front. Our attention was called by their harsh guttural notes; although they flew away several times, they always returned to the tall dead tree where we first noticed them. This is the first record for the Starling for our vicinity.

We have another interesting visitor to report in Henslow's Sparrow. It was first noticed on May 4th and remained in the same field for ten days. In fact it may still be there, but we were unable to catch its insignificant "song" on our last visit or two to the field on account of the number of Bobolinks, Kingbirds and Goldfinches that were flying about and filling the air with a babel of song. This is the second record for London (one having been heard last spring), and the bird has only been reported from some three other places in Ontario.

E. M. S. DALE, London, Ont.





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ON A NEW HELIOZOOON FROM VANCOUVER ISLAND

BY CHAS. H. O'DONOGHUE, D.Sc., F.Z.S.,

Professor of Zoology, University of Manitoba.

(From the Biological Station, Nanaimo, B.C.)

On the 25th of May Mrs. Edith Berkeley brought in some water, mud and debris from a small pond near the top of a hill above Hammond Bay Lagoon, about 420 feet above sea level. In this she noticed a very large Heliozoon, which she kindly handed to me for examination.

The pond is quite small and shallow, surrounded by a close growth of alders, and is apparently permanent. It contains a plentiful supply of several species of Algae (*Spirogyra*, etc.), numerous fly larvae, beetles and larvae, Copepods, Cladocera, and *Hydra viridis* and a number of flagellate forms.

The available literature has not yielded a description of a similar form nor is there anything like it in Wailes' excellent monograph number of this order (1) or Leidy's account of the Freshwater Rhizopoda of North America. As the present organism is remarkable in several respects, it seems worthy of putting on record.

The animal is of very large size and appears to the naked eye as a bright green sphere with a hyaline cover 2mm. in diameter; indeed, it was so large that it was at first thought that it might be a colony. Closer examination showed that this was not the case and that it was a solitary form, so that it is probably the largest Heliozoon known, the only one approaching it being *Actinosphaerium eichhornii*, which may attain a diameter of 1mm. It belongs to the sub-order Chalarothoraca in which the largest member is probably *Raphidiophrys viridis*, which

may reach 90 micra or the colony 190 micra. The present species is then approximately 22 times the diameter of the individual or 10 times that of the colony.

The body is spherical and measures 1.486mm. in diameter; it is enclosed in a mucilaginous envelope .540mm. thick. Beyond this again the stiff pseudopodia extend 1.892mm. so that the total diameter of the whole organism is 3.918mm. The pseudopodia are quite numerous, regularly arranged and project to an equal distance on all sides. They appear quite stiff and were not seen in active movement. The mucous envelope was only slightly granular and contained a few tiny spherical algae and still fewer somewhat spindle-shaped ones. On the outside of it were sparsely scattered tiny curved spicules apparently siliceous and somewhat pointed at each end. The envelope ran up a short distance on each pseudopodium.

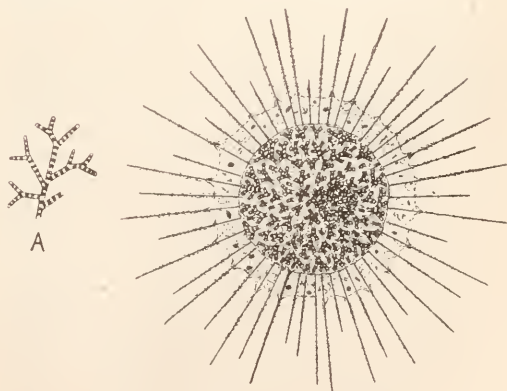


Fig. 1.—*RAPHIDIOPHRYS MAGNA*, general view. The darker area situated slightly eccentrically represents the nucleus and endoplasm. A.—A small portion of the symbiotic Algae to show their characteristic dendritic arrangement.

(1) The British Freshwater Rhizopoda and Heliozoa, by J. Cash, G. H. Wailes and J. Hopkinson, Vol. V, Heliozoa, by G. H. Wailes, London, Ray Society, 1921.

The ectoplasm of the animal was quite granular as far as was observed, had no contractile vacuole, and contained a large number of green cells. The zoochlorellae, however, were not scattered about indiscriminately, but were arranged in a very characteristic dendritic manner and so filled the ectoplasm that the internal details could not be made out. The basal stalk of each group started right deep down and branched frequently as it passed outwards, thus producing a tree-like effect with the short branches on the periphery. All the threads were of equal diameter and appeared to be composed of a series of units placed end to end, each one containing a large green chloroplast in the middle and having almost transparent ends. The result was that the thread had a banded appearance.

The nucleus and presumably the endoplasm was eccentrically situated and could only be seen by transmitted light.

The animal was kept under observa-

tion for more than six weeks in the hope that it would divide, but unfortunately during an absence on a collecting trip in the hot weather it apparently died, for it disappeared and nothing like it has been seen since in the small glass aquarium in which it was kept.

Using the classification by Wailes it belongs to the sub-order Chalarothoraca, i.e., Heliozoa having an external envelope composed of solid elements with or without a matrix of plasma. It also fits in most closely with his definition of the Genus *Raphidiophrys*, i.e., body enclosed in a mucilaginous envelope containing spicules (spindle, awl or disc-shaped), which normally extend outwards along the pseudopodia; nucleus and endoplasm placed eccentrically.

Provisionally, pending an opportunity for more detailed study, it is proposed to place it in this genus with the name *Raphidiophrys magna* to indicate its large size.

GLEANINGS FROM THE CANADIAN WEST. PART II. MAMMALIAN FAUNA OF ISLAY, ALBERTA.

By J. DEWEY SOPER.

What seems to me an interesting and essential consideration in respect to an animal study (aside of course from taxonomical and anatomical aspects), is the proper conception or imagery of its surroundings. So often the animal and its environment are surprisingly linked, again clearly dual, or as in some instances like *Blarina* and *Peromyscus*, of remarkable adaptability. In short, if we would really know the animal we need the knowledge of its habitat and abode. To assist in this, I have considered it proper to delineate in a few words the floral circumstances of the region around Islay.

It permits of three settings, the wooded; semi-wooded; and the prairie. The first is the usual poplar forest of the west, occurring in unbroken continuity only in the river valleys and their vicinity. This refers solely to the region of which I write, for in some places this is not the case. In the Vermilion and Saskatchewan valleys vigorous specimens of the balsam poplar (*P. balsamifera*) also occur, and in places the white spruce (*P. cana-*

densis) as well. The second is the park-like country which lies for the most part quite distinct and separated from the water courses, alternating its various-sized aspen (*P. tremuloides*) woods with prairie-land. This is very picturesque ground and particularly beautiful in autumn. In contiguity to lakes, it becomes practically an epitome of the last. The last, the prairie, seems self-explainable, but wide differences obtain even here from place to place. The Islay prairie, in the first place, is not entirely bald like that of some localities; neither is it on a dead level, both of which conditions add nothing to its attractiveness in my opinion. The surface describes an easy undulation, composed of greater and lesser swells and occasional engaging elevations such as the Twin Hills to the west and the Blackfoot Range, so called, to the south. Everywhere in this panorama are liberally dotted aspen bluffs of manifold shapes and sizes; clumps of wolf-willow scattered in between; and in every considerable depression, rings of red-willow that sur-

round grassy lagoons that were one-time sloughs. The first and last growths keep to high and low land respectively, while the wolf-willow seems to favor slopes and steep places, never in soaked depressions, but withal ranging indifferently. As a whole, the Islay prairies assume most interest, both from botanical and biological viewpoints, in proportion to their departure from monotonous nudity.

In addition to the country surrounding Islay, wherein the major number of my zoological excursions were confined, that is, in a four mile limit bounded by the Twin Hills to the west and Island Lake to the south, I had several opportunities of visiting remoter ground, the most interesting of which was to Laurier Lake on September 1, on which I wish to remark. It seems best, by way of presenting the facts in its connection, to couch it in narrative rather than in disjointed and purely technical form, in which latter much that gives tone to, and conception of, a visited region is necessarily lost. As this locality has never previously been investigated by any naturalist so far as I know, it seems more imperative to do a measure of justice to it at once.

Laurier Lake lies forty miles to the north of Islay, our proposed destination for the trip. The Vermilion and Saskatchewan Rivers must be crossed at a distance of five and thirty miles respectively. The car, our means of conveyance, was duly equipped the previous night for the outing, and all made ready for what we all anticipated as a great day's sport; nor were we disappointed in the smallest part. I should perhaps mention that the first was the opening day of the shooting season. The morning dawned in the most dispiriting manner, rain seemed imminent, but to experience the proper thrill with the day, and new country ahead, it seemed imperative to start with the dawn. Our judgment proved excellent, for by mid-forenoon the whole country was radiant with the matchless splendor of an Alberta morning. Never could skies be bluer or air so rare. As we spun along, occasional sharp-tailed grouse sprang wildly from the grassy trail with a staccato *cuc, cuc, cuc, cuc, cuc*, punctuating as they went their soaring and flapping flight. Nothing surely is more typically western and buoyant than these big handsome birds.

Just before descending into the Vermilion valley we had a glimpse of a Franklin's ground squirrel as it scampered into an aspen bluff beside the trail, the only one of the species I saw in the west. As the forenoon advanced the birds got warmed into action, and hourly before dinner were more in evidence. The near-by shrubbery trembled and flashed occasionally with passing warblers, and sparrows languidly twittered half-hearted snatches of song, fall-like and disconsolate. And that season, the fall of the leaf had seemed actually to have arrived, for the first few mourners were even now rocking slowly to earth. The very air had a hue or quality of autumnal vigor and adventure. Flickers watchfully explored the patches of prairie; robins in social flocks drove swiftly by with a *cheep, cheep*. Swainson's stately hawk cleaved the sky in level circles; and the delectable mountain bluebird, so tender and so elegant, chanced often to cross our path.

About ten a.m. we neared a series of shallow and grassy sloughs dotted with a few shoveller and ruddy ducks, and of more than passing interest in the wheeling and settling flocks of sandpipers that sought its plashy margins. Three species were plainly present, which after some studied "collecting" proved to be the lesser yellow, pectoral, and Baird's sandpipers. The latter was one of those choice finds, counted so to me, which comes new and unexpected. Until sending it to Ottawa I had mistaken it for the Least sandpiper, which it closely resembles.

We were now in the vicinity of the Ridge, a moraine-like elevation stretching for miles on either hand, and locally of interest because of the Indian graves which are said to dot its sides. According to rumor, the warrior dead were buried there after a retreat from the bloody massacre, during the rebellion, which occurred near the mouth of the Saskatchewan. As this location is some twenty miles from the Ridge, the wounded evidently needed some help, especially the ones who forever will remain on the Ridge. I had no time to verify the existence of the graves, but I believe without doubt, remembering the source of my information, that they are there. The whole country should be interesting, anthropologically, for it seems

a vast burying ground for that departing race; here and there about the country relics are frequently found, and in two instances in fact, I have knowledge of their discovery. Both specimens I have in my possession. The one is a stone-hammer, three pounds in weight and in perfect condition (with the exception of a single chip out of one side), which I found near the Twin Hills. The other is a round stone ball, three inches in diameter and one pound in weight, picked up in a locality a few miles south of Islay where many others similar in weight and identical in appearance have been formerly found.

The panorama from the crest of the Ridge is a memorable one. The majestic prairies, alternating with aspen woods and terminating in the distant blue hills of the Saskatchewan, seem so peaceful and primeval that only a rugged column of buffalo is required to complete the circumference of one's reflection. Nearing the Saskatchewan, the woods become denser and more continuous, until, entering the valley system itself, the balsam poplars thrive in vigorous groves; the aspens crowd thicker and thicker and attain to greater height, and a few birch silhouetted here and there foreshadow the genuine borean forests. A peculiarity of these woods, and doubtless remarked by anyone passing them, is the exhalation of a mildly pungent and sour aroma that characterizes them, particularly during the fall, with the decadence of the leaves, and especially towards sun-down. It is neither fragrant nor wholly disagreeable, but remarkable for an illusive quality that inspires a really unmistakable tingle of adventure. It is but one of the many odors of the autumn woods, that make of a trip there a thing of rare enjoyment.

Ferrying across the muddy Saskatchewan with its surrounding wilderness of forested hills was not the least of the day's attractions; nor was the ascent by the winding wooded trail beyond. A proper panoramic view of this valley long lingers in the recollection. On a jutting sand-bar at the bend of the river, deer trails were in evidence; and the bar was said by the government ferryman here to be a regular resort to which they came from the woods to drink. Although it was merely fortuitous, we noted no

ruffed grouse until north of the river, but now they frequently rose at our approach and bulleted through the woods. More often, however, as is their usual custom in the west, they merely walked slowly and pertly from view, whimsically clucking and spreading ruff and tail.

All along the route the prairie rose still bloomed, and occasional sequestered hollows were blue with violets even at this advanced date. Four species of fungi were noted all along the way, being, or most resembling, *Psathyrella disseminata*; *Leptota naucinoides*; *Calvatia caniformis*; and *Calvatia gigantea*. It is of further interest to note that neither the common raspberry nor hazel bush was observed until north of the river, becoming then of common occurrence.

The lakes are a particularly interesting locality. The conditions are so diversified that doubtless an equally divergent series of small mammals could be taken there consistent with it. My stay, unhappily, was of short duration, or much of the wistful speculation which I secretly bore to the woods would have become an instructive reality. In theory one has all the small mammals possible to the region, each in its own peculiar situation, from *Eutamias gapperi* in the mossy spruce swamps, to *Peromyscus borealis* on the aspen ridges, besides all the intermediates. The jumping deer are residents here, for numerous trails belonging to them were observed on the sandy beach at Laurier Lake. The latter is a fine body of water of considerable size, and yields several species of fish, some of which attain to very respectable dimensions. Whitney Lake, its sister, about a mile distant, is neither so large nor becoming, but its tortuous shore-line, with numerous secluded bays hemmed in darkly by the woods, creates a resort among the waterfowl that is quite unknown to the other. The day we were there, a single duck, a horned grebe, and two herring gulls, so far as I remember, were the only fowl we saw on Laurier, while on Whitney some coves were fairly black with them. Both lakes are surrounded by heavy coniferous woods, consisting of white spruce (*Picea canadensis*), tamarack, (*Larix laricina*), paper birch (*Betula alba*), balsam poplar (*Populus balsamifera*), and the trembling

aspen (*Populus tremuloides*). The conifers range back only a comparatively short distance from the lakes, forming an encircling collar about them, then being replaced entirely by the usual growth of aspen. The soil in places is very sandy, notably a streak between and to one side of the lakes, on which subsist small examples of jack pine (*Pinus banksiana*), developing further along into quite extensive groves. The general effect of the landscape reminds one of the stunted forests in the region of Lake Superior, particularly in the Hudsonian zone. The analogy is further heightened by deep spongy ground-moss that covers the low areas in places near the lakes, the logs and trunks covered with dull lichens, and the "old man's beard" that waves from the sepulchral spruces.

RICHARDSON GROUND SQUIRREL.

Citellus richardsonii (Sabine).

The Richardson ground squirrel by far exceeds in number any other mammal of the region, with one exception, and that doubtful — *Microtus drummondii*. Colonies are nowhere extensive, due no doubt to the proximity of its northern limit (none were observed north of the Saskatchewan river); but individuals are scattered everywhere in hundreds. The most flourishing colonies are invariably found on high rolling lands usually on the slopes, and preferably in gravelly clay, but burrows are evident in all but the wettest locations. In places the comparative smoothness of the prairie is broken by innumerable dark earth heaps, throaty burrow entrances, and sunken runs. These last are used regularly as highways from one community to another, and as a rule are traceable by the eye from a distance, especially if viewed from a slight elevation. Like life, as a maze of endless continuity with its thousand currents crossing and counter-crossing and crossing again, these little prairie trails lead hither and thither, a perfect labyrinth, to both puzzle and entertain. In long grass or grain this system becomes, of course, much less evident, if not entirely hidden.

My first day at Islay, August 27, was principally taken up with this animal, both because of its abundance and the im-

mediate access to its study. If approached slowly, ground squirrels or gophers remain head and shoulders exposed until your nearness sends them earthward at a vital moment with a flick of the tail and a husky whistle. A few are content to court human company at short range, feeding meanwhile within easy access of their burrows, but others again disappear at the first alarm. When sitting erect or crouched at burrow-mouth, somewhat timorous or moved by mildly-excited curiosity, a striking characteristic is the upward flick of the tail in time to a husky chirp. From this it has doubtless derived the local appellation of flicker-tail. An interesting experience when a whole colony has been frightened underground is to lie motionless on the prairie, and watch them reappear one by one and resume their several inclinations, which they readily do in a few minutes. Apparently already forgetful of their recent alarm, they exchange in low drowsy calls their expression of content in the mellow sunshine of the morning.

During September, in certain localities, hundreds of small drillings in the soil indicate the ground squirrels' activity in garnering a species of grass root or bulb. They also collect, so I was informed, the red berry of the wild rose and a low shrub blueberry resembling the huckleberry which grows sparsely on the prairie. In addition to these, they take a heavy annual toll from the grain-fields.

At Islay the gophers' nearest mammal neighbors are the two species of vole, the long-tailed weasel, and the badger. Habitually the two last prey upon the three first. On numerous occasions I have seen groups of badger borings in ground squirrel colonies with the evident purpose of feasting on those animals, but it is usually hard to tell with what success the badger meets. Some holes are shallow, while others are several feet in depth; the former I presume are merely prospect shafts. As the badger digs anywhere in the wildest abandon, without reserve, art or discrimination, it is often difficult and even impossible to decide which are dens and which prospects. Even after the snowfall of Oct. 8, these prospect shafts continued for a time as numerous and fresh as ever,

and were particularly conspicuous against the white of the landscape.

After the snow I followed weasel trails frequently and found that they freely went in and out of all gopher dens that lay conveniently to their course. As a diet the gopher is evidently highly regarded by this animal, but I found it impossible to ascertain when they explored with success. It was incredible that there could have been a gopher in each of the burrows visited, for in the course of a night's run they seemed almost innumerable. I never had the patience to follow to the end in all its intricacies the night's trail of an ermine, although my wanderings in this regard have been really extensive as a whole, and not without a like measure of enlightenment and pleasure.

An old plainsman told me that once from his horse, he watched a prairie weasel enter a Richardson's ground squirrel colony when the majority of the members were under ground. He bounded easily but furtively about from mound to hollow and through herbage, lithe as a reptile, and nosing the ground occasionally like a hound. Presently there caught his eye an isolated and unlucky gopher liberally separated from his burrow. The latter was feeding with his back towards the weasel, but at this moment, apprehending danger by some subtlety, he clumsily wheeled and made a few frightened jumps towards his home. The weasel met him with the thirst of conquest, severing all hope of escape. In a flash the gopher, realizing this, sank back threateningly, chattering and screeching hoarsely with terror; the next breath and the two were mixed in combat. But, strange to relate, attracted by the confusion of wails and weird vocal pirouettings from the expiring gopher, relatives and neighbors shot out everywhere from their burrows, and poured in one averting or avenging mob about the ears of the aggressor. Left alone with one gopher the weasel is undoubtedly happy, but this chippering, champing, insane rabble was too much. He breasted the tide gallantly for a while, lost heart, and remembered a pressing engagement in another quarter; or were the grapes sour anyway? A few gophers followed him for a short distance by way of impressing further the ignominy of defeat, then returned with declining ardor to dis-

perse gradually to their separate dens. My informant remarked that the whole was so quickly enacted that he sat in the saddle half bewildered, scarcely able to comprehend the fleeting bit of wild drama that had passed before his eyes. Even the outraged gopher, he said, had so far recovered, that when he rode down into the colony it too limped its way along and disappeared, leaving the prairie still and deserted.

In regard to the hibernation of this gopher I was agreeably surprised. I had received the impression in some manner that, like the woodchucks of the east, they disappeared in mid-September; instead, however, they braved the rigors of October and even that of November. After the snowfall of October 7 they dug upwards through the snow as numerous as ever, but the succeeding cold and snow put the majority under by the middle of the month. On October 29, near a wolf-willow clump on the prairie, I noticed where an ambitious individual had tunnelled along under a few inches of snow for over twenty feet. This subterranean work was carried at intervals so near the surface that detached portions caved in, exposing the run below. In other instances, by the dirt mixed with the snow, the passage seemed driven directly in contact with the earth. For several days in early November, though the mercury was much below zero, an unusually hardy animal, reluctant to assume the long sleep, daily scampered to and fro between den holes in the snow separated by several yards.

FRANKLIN GROUND SQUIRREL.

Citellus franklinii (Sabine).

The northern range-limit of this brushland cousin of Richardson's gopher, must almost coincide with that of the latter animal, from all information I could get; but in point of abundance there is no comparison between the two. Richardson's squirrel is almost everywhere south of the Saskatchewan, while Franklin's seems highly restricted in its range, and at Islay is nearly absent. I sighted one as it ran into a bluff near the Vermilion river on September 1, but never saw another, although five days later on a beautiful afternoon I hunted this and other promising localities along the valley until nearly night. Search for them in other localities was likewise fruitless. Information from

several sources indicated that it was more likely to occur on the brushy west slopes of Pleasant Valley than anywhere else, a locality I was unable to visit. I had also reports of its occurrence in the region of Raft Lake, where it visits the portable graineries drawn up near the woods.

STRIPED GOPHER.

Citellus tridecemlineatus tridecemlineatus (Mitchell).

Rare at Islay. It seems strange that the single individual responsible for this entry should have made its home under the very foot-path of the village. But there it was, well satisfied apparently with the resounding tread of feet above its head. Old inhabitants recognized it as an animal occurring at various points throughout the region.

LITTLE CHIPMUNK.

Eutamias quadrivittatus borealis (Allen).

Mr. Sydney Blair of Dewberry, a keen and interested observer, states that the little chipmunk ranges in the dry aspen woods surrounding Raft Lake, often making excursions to the fringes of the grain fields which here meet the woods. I expected to find it in the Vermilion valley, but, as in the case of the Franklin's ground squirrel, my most ardent exploration failed to discover it. After an acquaintance with it at Edmonton I felt particularly desirous of seeing it again, but that pleasure was denied.

HUDSON BAY FLYING SQUIRREL.

Sciuropterus sabrinus sabrinus (Shaw).

Reported as occurring in the mixed and denser portions of the spruce and poplar woods at Raft Lake. Doubtless, may be found also along the Saskatchewan and perhaps Vermilion rivers, as frequently I secured them under like conditions at Edmonton.

HUDSON BAY RED SQUIRREL.

Collected on September 1st a single specimen (male) in the spruce woods off the east shore of Whitney Lake. The summer pelage shows no sign of shedding. The underparts are distinctly more creamy-buff than any of my earliest October specimens taken at Ridout, northern Ontario, 1918. This specimen measures: Length, 310; Tail, 115; Foot, 48.5. Bulky nests of shredded

bark etc., belonging to this animal, were fairly common in the conifers at Whitney. The only sign I saw of it at Laurier Lake was a fragment of mushroom wedged in the branches of a large spruce.

PRAIRIE HARE.

Lepus campestris campestris (Bachman).

Formerly unknown, but gradually migrating northwards. During my stay one was flushed on a grain field a bare mile south-west of the village, which was affirmed by all with whom I talked concerning it as the first known event of the prairie hare in the vicinity. It had never previously been seen nearer than sixteen miles to the south, and that only a single individual three years before. The northward fringe of its range seemed indefinitely fixed away to the south, of late years pushed polewards by a few adventures on a line with Wainright, until this fall a crusader appeared far beyond the natural range, perhaps the advance-guard of a general future movement. The clearance of the land is undoubtedly the incentive, much like the invasion of southern Ontario by the prairie mouse (*P. m. bairdii*) of late years.

SNOWSHOE RABBIT.

Lepus americanus americanus (Erxleben.)

Scarce this fall, but in the recurring cycle of its septennial abundance scouring the country in thousands. Sometimes, according to an informant, entire aspen bluffs are 'barked' until they die. After the snow fall of October 7, their widely scattered trails were occasionally seen.

CANADA WOODCHUCK.

Marmota monax canadensis (Erxleben).

Occurs only very sparingly at Islay, and perhaps so over the entire west. Any individuals which I have seen were noticeably smaller than the familiar woodchuck of the east. A specimen taken at Edmonton in September 1912 was only about two-thirds the size, reddish and grizzled however similar to the latter. This may have been an adolescent.

BADGER.

Taxidea taxus taxus (Schreber).

Very common: badger holes were in evidence at intervals nearly everywhere. Most of these were doubtless prospect shafts in search of gophers. Sometimes in colonies of the latter a half dozen may be sunk

in a single night in addition to much travelling and digging in other places. They are powerful and effective excavators and what may be assumed as the work of several may be the work of one. I shot one near the Vermilion in early September. Dusk was just creeping over the prairie, when passing near a cut bank we caught a glimpse of something moving about, and approaching saw one of these animals slouch into a hole it had freshly dug there. It soon reappeared, sniffing curiously, with its nose high in the air, then suddenly disappeared again. After a wait of five minutes it boldly repeated its tactics in an attempt to solve the mystery of its visitors.

CANADA LYNX.

Lynx canadensis canadensis (Kerr).

Formerly common in the wooded Vermilion basin, and apparently a few still breeding there, but now nearly trapped to extinction. Last year an adult and two young were killed three miles north of Islay.

PORCUPINE.

Erethizon dorsatum dorsatum (Linnaeus).

At Islay the porcupine is encountered only at very rare intervals. The nearest woods of any particular density lie along the Vermilion river four miles to the north. While driving in this basin on July first two years ago, my brother-in-law Mr. William East of Islay came upon one loitering near the trail. This is the only one he had seen there after many years residence.

MUSKRAT.

Ondatra zibethica spatulata (Osgood).

Perhaps a great factor in the general depletion of this animal of late years has been the gradual subsidence of scores of sloughs and small lakes throughout the region, until now great numbers are either totally dry or nearing that condition. An area of hundreds of acres west of town, once a lake ten feet in depth and the home of hundreds of rats, is now as dry as the rest of the open range, fed over by stock and yielding alike good crops of natural hay and Drummond's vole. A tract opposite the station which a few years ago provided excellent duck shooting, is now entirely dry. Scores of like incidents could be cited. The lakes remaining are of course gradually sinking, and, as at Is-

land Lake, one time islands are slowly rising to the dignity of peninsulas when lying off shore. Richardson's ground squirrel has already established himself on these with alacrity. It is estimated that between one and two thousand muskrats inhabited the dried-up lake west of Islay in pre-settlement days. This has an area of approximately one and a half square miles. Two trappers, operating between Edmonton and Vermilion via the Vermilion lakes in 1908, took for fall and spring 3,900 muskrat skins. From Manville to Vermilion, on the Vermilion river, a distance of about fifty miles, one party in the old days took 2,500 skins, and I understand this was for the fall only. Today the majority of these places are nearly destitute.

PRAIRIE SKUNK.

Mephitis hudsonica (Richardson).

This species is not at all common but is generally known throughout the country.

MINK.

Mustela vison vison (Schreber).

Very rare. Only one mink trail observed in thirteen years by an old resident pioneer. This was on a mud bar of the Vermilion.

CANADIAN BEAVER.

Castor canadensis canadensis (Kuhl).

Almost exterminated. One family of bank beaver known to exist still near the confluence of the Vermilion and Saskatchewan rivers.

PRAIRIE WOLF OR COYOTE.

Canis latrans (Say).

Much more plentiful formerly, but still common. On November 23 five locally caught skins were sold in the village. Numerous animals were sighted during the fall. Some time in October, after the snow, one intrepid individual raced ahead of our car down the trail, leaving it only as we approached to within about twenty-five yards, then side-stepping just sufficient to get screen behind some low willows that lined the ditch. As we dashed by he stood there partly visible, wearing a languid quizzical grin that was comical in the extreme. After the snow fall of October 7, 8, to sight their trails was a daily occurrence.

LONG-TAILED WEASEL.

Mustela longicauda longicauda

(Bonaparte).

A very common species on the prairie, but their presence, unless by one purposely seeking them, would pass unsuspected. A specimen taken on October 18 was still brown dorsally, but shedding rapidly, with a thick fine coat of white replacing it beneath. About November 3 half of the specimens collected had a scattered but diminishing quantity of brown, while all those after the sixth were pure white. A wide-spread individual variation prevails in completing the moult, although each and all, it will be noted, exist under the same local conditions. Occasional weasels had completed the moult before November 1, while others in a like environment a week later still presented a thin brown shade their entire dorsal length.

Following are the measurements of *longicauda* taken in the vicinity of Islay.

Sex	Length	Tail	Vert.	H.	Foot
Male	430	140	50		
Male	450	155	50		
Male	445	155	50		
Male	475	175	50		
Female	390	140	45		
Female	365	125	40		
Female	370	130	42		
Female	400	145	45		
Female	375	125	47		
Female	380	130	46		

Throughout periods of intense cold and even winter storms the long-tailed weasel seems to pursue activities without abatement. Many animals, though remaining active throughout the winter, are clearly more so during the lulls of fine weather. Often have I observed the suspended activity of such as red squirrel and mink during and succeeding violent winter storms. But the long-tail pays little heed to these. On November 5, although snow fell for the entire day before and part of the succeeding night, the ermine was found to have been around and about his business as usual. They doubtless travel on the coldest and stormiest nights of winter, and, in the case of the long-tailed species, over the bleakest and most exposed ranges.

Their chosen field is the open prairie where they wander erratically from place to place, visiting wolf-willow clumps, gopher holes, odd stones, aspen bluffs, and any other irregularities which appear in

their line of travel. Their life seems an endless roving in search of food, conducted without design, lacking home and apparent destination. This may be regarded as a superficial impression. Having spent many hours upon their trails in the snow and cold, untravelling as it seemed a clue to their very lives and destiny, I have discovered the opposite to be the truth. Although their wanderings seem the most erratic and inconsistent imaginable, there is yet beneath it a species of method. I have never been able to connect positively their widely scattered trails with a fixed abode, but I have learned that they habitually return again and again over the same route. The male in particular is perhaps always detached, leading an irregular and nomadic existence. While this may be true, it is seen that a relatively fixed locality is adhered to for their hunting, and is withal, considering their size, of very considerable extent.

DRUMMOND VOLE.

Micotus drummondii (Audubon and Bachman).

Despite the drouth of last summer, which doubtless had a negative effect on the procreation of such moisture-loving animals as this species, it still remains, with one exception, the most abundant mammal of the region. It is found only in damp situations or the nearest to this condition. Ranchers making hay in September on the dry lake bottom west of the village reported considerable numbers of this vole, and I found their runways in the arching grass of nearly all low moist places over the prairie. Their most fruitful habitations are those cup-like depressions among the hills which were once brimming sloughs but now no moister than the average lowland pasture. They look odd now, with the precise elliptical willow borders surrounding those hollow and grassy lagoons. The vegetation in these places is quite luxuriant, opulent with the fragrance of pennyroyal, and mystically entangled enough for any rodent recluse. The ground, covered with herbage, is broken into myriads of little hummocks, among which the eccentric trails wind and criss-cross about, some expunged in the near distance and others winding in baffling intricacy to finally disappear in miniature caverns in the turf. The 'rails

are neither so numerous nor well defined, however, as those I have seen in the east and north, where oftentimes the natural meadows were perfect labyrinths of interlacing trails, and vegetation and muck were irreparably united in highways of unusual foulness.

Measurements of *drummondii* collected at Islay, Alberta.

Sex	Length	Tail	H. Foot
Adult, Female	150	35	18
Adult, Male	140	35	17
Adol., Male.. ..	127	30	16
Juv., Male.. ..	112	27	17
Juv., Male.. ..	95	20	16

LEAST UPLAND VOLE.

Microtus minor (Merriam).

To me the discovery of this mouse was of more than ordinary pleasure; not merely because of its comparative rarity or its newness to me, but also because of the conditions it represented. It is not confined to dank bottomlands like *drummondii* but climbs to the raey pastures far above. It loves the prairie crests and its spicy winds, the flowing undulations of fragrant herbage, and the rustle of the wolf-willow. In the very expression 'upland' one feels a subtle suggestiveness that floats the mind instinctively to the lonely north, the north with its glamour of brooding plateaus, its silent and immutable tundras.

At Islay the upland vole casually occupies the lushier lowlands, not much in elevation above *drummondii*, but always, so far as I could learn, on ground never subject to inundation, which is distinct from that of the latter. The local habitat of the two, if not actually overlapping, certainly is subject to a very fine delimitation. In the matted grass of willow-grown but elevated flats it is as likely to be found as anywhere, although its presence is by no means as certain as the other species. When finally located its sparse trails will be found leading languidly among the willows, rose bushes, and herbage; tunneled through the latter rather than over; fashioned round without a break for considerable distances. On the slopes or in creases of the prairie it lurks in grassy tangles beneath wolf-willow and aspen, and at times, as previously mentioned, turns to the very crest of ridges that are gilded with the first and last lights of dawn and sunset.

Unlike the vexing separation of many members of this genus, the present voles are palpably distinct; with the two side by side, colour difference alone suffices to separate them. *Drummondii*, heavy set, and of a reddish-grey colour, contrasts clearly with the slighter build and silvery-grey of *minor*. For a time, while trapping, the occurrence of these two colorations, which I distinguished from the first, proved rather puzzling. Having no literature along led me erroneously to imagine it a seasonal phase on the same species. In trapping, however, I noticed that each 'phase' singularly appeared separate, which led me very early to suspect the truth, as is shown in this journal entry: September 26 — "A second specimen tonight of the grey *microtus*, both from the same trap. It would appear that this animal is perhaps a distinct variety from the reddish-grey vole. At any rate a cursory examination of the few *microtus* taken here suggests this;" and again for September 27, I find in part this note: "Succeeded in capturing another silvery-grey vole. Reference was made to this animal on both the 24th and 26th. This one of to-day as well as the others were all taken in the same trap and locality and only at a slight elevation and distance from the lower ground where I succeed in collecting only the brownish voles."

Islay is close to the northern limit of its range.

Measurements of Islay specimens of *microtus minor*:

Sex	Length	Tail	Foot
Male	110	18	14
Male	115	17	15
Female	115	23	14
Female	108	17	15
Female	116	22	15

BAIRD'S MASKED SHREW.

Sorex personatus haydeni (Baird).

Only two of this diminutive and rather obscure animal were collected at Islay. Both were taken in the same trap and in the same damp lowland where most of my *drummond* voles were captured. They appear to be rather uncommon. A plainsman told me that in passing low places at night he had frequently seen these shrews darting across the trail under the glare of the head-light on his ear. The two specimens secured are noticeably smaller than

any of this species I have previously taken elsewhere. It was first thought that they would prove to be *Microsorex hoyi*, but a dental and cranial examination rendered them referable to the above *personatus* subspecies. Dr. R. M. Anderson of Ottawa kindly identified these for me, as he did also all the other small mammals secured on the trip. The Islay specimens of *haydeni* measure: Length, 85-82; Tail, 24-22; Foot, 10.5-11 mm.

In addition, I have the following statement from Mr. Henderson, Acting Chief of Bureau, U. S. Biological Survey:—"Your specimens have recently been critically examined by Dr. Jackson, and he considers that they are referable to *Sorex personatus haydeni* as you suspected, although, as above intimated, your specimens are from a point considerably west of the previously known range of this form. He reports that they approach *S. personatus* in relative narrowness of the rostra and in color."

NORTHERN WHITE-FOOTED MOUSE.

Peromyscus maniculatus borealis
(Mearns).

At Islay the deer mouse is either very uncommon or exceedingly seclusive; I favor the former view-point. In all my rambles and exploring only a single specimen was either seen or taken, and that only by merest accident. Usually a collector secures his specimens by clear design and is rewarded in direct proportion as he may assiduously practise it, but my specimen came without that. I was walking near the Twin Hills on September 11 and close to some old homestead buildings when, chancing to cross a portion of old board on the ground which I kicked in passing, an adult white-foot leaped away and danced about looking for escape, but that was rather reluctantly denied him. Without this contingency I should have been entirely unaware of the presence of this species. It shows a very pronounced darkish-brown dorsal band; buffy cheeks; white pencilling on the ear rim, and pallid plumbeous-grey underparts. Measurements: Length, 140; Tail, 40; Foot, 18, (Male).

JUMPING MOUSE.

Zapus hudsonicus.

Not common. A single individual observed on the north-western outskirts of

the village. As so often occurs, it made its escape; at times it requires about three men and a dog under the most favorable circumstances to successfully compete with a jumper for its life.

THE BIG GAME.

To a genuine nature-lover, one of the most ominous tendencies of the day at Islay is the gradual depletion of the big game. The game must go of course as a natural consequence of settlement, and where it is going, but not gone, it is still but a prophecy of the future. The graphic tales of early days to which one eagerly listens now, portraying their wild and romantic abundance, perhaps on the very spot you occupy, serves but to accentuate their present absence, their irrevocable and irreconcilable loss. The comparative speed with which they sometimes disappear is also a significant item. Previous to 1910 at Islay the moose and mule deer were tolerably common in all the wooded river basins, but now both are gone entirely from the vicinity and a bare ten years has passed. While the moose may still be found in pretty fair numbers a considerable distance to the north, the other is considered nearly extinct. The blacktail deer was formerly common, but is now very rare. Elk in the old days, according to information, came and went in sizable bands, but they are a stranger there now, and the nearest is a restricted company to the west of Primrose Lake a hundred miles to the north. The jumping deer has fared much better. As mentioned elsewhere, it is still found in the Saskatchewan valley, and all through the woods northward to the lakes already referred to. Occasional ones may yet survive in the remoter nooks along the Vermilion river, especially towards its confluence with the Saskatchewan. Where other big game either perish or retreat, the jumper frequently loiters with impunity. It loves to dabble about the skirts of civilization, and even increases with a little encouragement. At Edmonton, in 1912, I often saw them or their fresh beds within three miles of the city, and that with a population of seventy thousand people. Instead of retreating like the wary moose, they linger on, secretively gazing on the strides of industry, relishing the settlers' first succulent crops, and then at last, succumbing on the soil of their birth.

A CONTRIBUTION TO THE ALGAE FLORA OF THE OKANAGAN (BRITISH COLUMBIA).

BY E. D. SISMEY.

CLASS MYXOPHYCEAE.

Order I. COCCOGONEAE.

1. *Dactylococcopsis montana* W. & G. S. West, in lake plankton.
2. *Merismopodia elegans* Braun, in ditches, April.
3. *Aphanocapsa spec.* not determined.

Order II. HORMOGONEAE.

Family. Seytonemaceae.

4. *Scytonema myochros* (Dillwyn) Agardh, growing on rocks moistened by water at Peachland, May.

Family. Nostocaceae.

5. *Nostoc depressum*, Wood, Penticton Creek flume, May.
6. *N. microscopicum*, Carmicheal, from squeezings of a water moss resembling Sphagnum, June.
7. *Nodularia spumigena* var. *genuina*, Bornet & Flahault, in ponds Indian Reserve, May.
8. *N. Harveyana* (Thwaites) Thuret, in sloughs, Pen, May.
9. *Anabaena inequalis* (Kutz), Bornet & Flahault, small pond Indian Reserve, June.
10. *A. flosaquae*, Breh, free floating in sloughs.

Family. Oscillatoriaceae.

11. *Phormidium autumnale* (Ag) Gom, on wet rocks at Peachland, B. C., May.
12. *Oscillatoria limosa*, Ag, in small pond Dog Lake.
13. *O. formosa*, Bory, Penticton sloughs.
14. *O. geminata*, Menegh, outlet of a septic tank.
15. *O. agha dii*, Gom, in pond Dog Lake with *O. princeps*.
16. *O. princeps*, Vauch, free floating balls in small pond Dog Lake. This huge Alga is uncommon.
17. *O. boryana*, Bory, at the outlet of a septic tank.
18. *Spirulina major*, Kutz, Penticton Creek in ponds.
19. *S. meneghiniana*, Zenard, moss squeezings.

Family. Rivulariaceae.

20. *Rivularia pisum*, Ag, in water moss, Dog Lake; also on weeds, Ok Lake.

21. *Calothrix parasitica* (Chauvin), Thuret, growing on a floating log, Dog Lake.

PERIDINIEAE. — I have omitted this group from this list not only because I have no literature on the subject, but because some authorities group them among the Flagellates. Whatever view is taken the Peridinieae may be left out without spoiling the general balance of the list. They are naturally a subject for a special study. The Peridinieae are of considerable economic importance as they are large storers of reserve food material, thus forming a basic food supply for countless small organisms.

BACILLARIEAE. — The Diatoms are universally acknowledged to be a subject for a special study. As some 12,000 species (including fossils) have now been described it is difficult to attempt to enumerate species in a list of this kind. At the same time, as Diatoms usually form a considerable proportion of the plankton gatherings I include several genera with some specific identifications in my plankton notes of Okanagan Lake. In this respect the diatoms are of special interest in establishing periodicity curves, and also, *en passant*, a great many points of biological interest may be observed.

CLASS CHLOROPHYCEAE.

Division I. ISOKONTAE.

Order I. PROTOCOCCALES.

Family. Volvocaceae.

Sub-family. Chlamydomonadeae

22. *Chlamydomonas spec.* in slough plankton. Identification of species a matter of great difficulty, there being a difference of opinion among the best authorities. The Genus *Chlamydomonas* occupies a position of great interest among the green algae. It is looked upon as the starting point in

the evolution of green Algae and perhaps of all plant life.

Sub-family Phacoteae.

23. *Phacotas spec.* not determined. The same difficulties surround this genus as above.

Sub-family Volvoveae.

24. *Gonium pectorale*, Mull, in green scum in vast numbers at bottom of slough, May.
25. *Pandorina morum*, Mull, common in sloughs.
26. *Eudorina elegans*, Ehrenb., common in slough plankton.
27. *Volvor aureus* (L) Ehrenb. This alga was to be found in vast numbers in the slough plankton during the latter part of May.

Sub-order TETRASPORINEAE.

Family Palmellaceae.

Sub-family Tetrasporeae

28. *Tetraspora lubrica* (Roth) Ag, on stones at the outlet of a small spring, Summerland, May.

Family Protococcaceae.

29. *Trochiscia aspera* (Reinsch) Hansg., common in plankton.

Family Autosporaceae.

Sub-family Oocysteeae

30. *Oocystis solitaria*, Wittr., slough and lake plankton.

31. *O. crassa*, Wittr., as above.

32. *Nephroclytium aghardianum*, Nag., from squeezings of a moss resembling sphagnum.

33. *Tetracoccus botryoides*, West. lake plankton, April.

Sub-family, Selenastreae.

34. *Scenedesmus bijugatus*, (Turp) Kutz., lake and slough plankton.

35. *S. quadricauda*, (Turp.) Breb, as above.

36. *Ankistrodesmus setigurus* (Schrod) West, slough plankton.

Order 2. SIPHONALES.

Family. Vaucheriaceae.

38. *V. geminata* (Vauch) DC. Dog Lake in ditches. Vaucheria grows in felty masses like moss and may be recognized from other algae with the naked eye.

Order 3. SIPHONOCADIALES.

Family Cladophoraceae.

Sub-family Cladophoreae.

39. *Cladophora cispata*, Roth. Penticton Creek, Sept.

Sub-family Rhizoclonieae.

40. *Rhizoclonium hieroglyphicum*, (Roth) Kutz. sloughs, also Marron Lake.

Order 6. ULOTRICHALES.

Family Ulotrichaceae.

41. *Ulothrix zonata*, (Web & Mohr) Kutz., common, found in many stations at all seasons.

42. *U. subtilis*, Kutz., Okanagan Falls, Apr., growing on stones under water, where current was swiftest about 12-15 miles per hour.

Family Microsporaceae.

43. *Microspora tumidula*, Hazen, Dog Lake, entirely an American species.

44. *M. stagnorum*, (Kutz) Lagerh., common in pools more or less stagnant.

Family Chaetophoraceae.

Sub-family Chaetophoreae.

45. *Chaetophora pisiformis*. (Roth) Ag. growing on a floating board. Sloughs.

46. *C. elegans* (Roth) Ag. growing on a dead stick, sloughs.

46. *C. elegans* (Roth) Ag. growing on a zen, Dog Lake on a submerged log.

48. *Draparnaldia plumosa* (Vauch) Ag., free floating Ok Lake.

49. *Draparnaldia glomerata*, (Vauch) Ag., on dead tule (Scirpus spec.) Pen sloughs.

50. *Myxonema tenue* (Ag) Kutz., Ok Lake.

Sub-family Microthamnieae.

51. *Microthamnion Kutzingianum*, Nag., on dead tule (Scirpus spec.) sloughs.

Division II. AKONTAE.

Order 1. CONJUGATAE.

Family Zygnemaceae.

Sub-family Mesocarpaeae.

52. *Mougeotia spec.* This genus is quite common, sterile filaments only.

Sub-family Zygnemeae.

53. *Zygnema ericetorum* (Kutz) Hansg., in drying pond by Okanagan River.

Sub-family Spirogyrae.

54. *Spirogyra tenuissima*, (Hass) Kutz., ponds Penticton Creek, May.

55. *S. inflata* (Vauch) Rabenh., as above.

56. *S. nitida* (Dill) Link., ditches Penticton, April.

The family *Zygnemaceae* is perhaps the most widely scattered and by far the most noticeable of all the algae.

That bright green hair-like growth so common in ditches and ponds is usually made up of one or more members of this family. Time will enlarge this group greatly in Okanagan. Specific identification is possible only when filaments are in a fruiting condition and zygospores present, an occurrence not of great frequency. As yet I have had no success with artificial cultures.

Family Desmidiaceae. This family is not represented in this list as the writer has no literature on the subject. The extreme difficulty in the study of Desmids and the comparative scarcity of good literature renders it a subject for separate study. The Desmids are none the less of extreme beauty and great interest, especially in the apparent connection between the richness of the Desmid flora and the older Geological formations. In future, however, I shall be in a position to assign the Desmids to their respective genera.

Division 3. STEPHANOKONTAE.

Order 1. OEDOGONIALES.

57. *Oedogonium* spec., sterile filaments only have been collected. Specific identification is impossible except when in a fruiting condition, and even then it is a matter of difficulty.

Division 4. HETEROKONTAE.

Order 1. HETEROCOCCALES.

Family Chlorosaccaceae.

58. *Stipitococcus urceolatus*, West, epiphytic on *Rhizoclonium hieroglyphicum*.

Family Botryococcaceae.

59. *Botryococcus Braunii*, Kutz., very common in plankton at all seasons.

Order 2. HETEROTRICHALES.

Family Tribonemaceae.

60. *Tribonema bombycinum* (Ag) Derb & Sol, common in ditches.

61. *T. bombycinum forma minor* (Wille) West, as above.

Order 3. HETEROSIPHONALES.

Family Botrydiaceae.

62. *Botrydium granulatum*, Ehrenb. (L) Grev., uncommon and very interesting; found on the drying up mud of a small lake, May. Growing on flumes (at the junction of the boards, where slow leakage occurs) to a size much larger than usually recorded.

CLASS PHAEOPHYOEAE.

Order SYNGENETICAE.

Family Chrysomonadinaceae.

63. *Synura uvella*, Ehrenb., slough plankton.

64. *Uroglena volvox*, Ehrenb., as above.

Family Dinobryaceae.

65. *Dinobryon cylindricum* Imhof., slough plankton.

The system of classification used in this list is that of Prof. G. S. West in his work on Algae, Vol. 1, Cambridge Botanical Handbooks, 1916. It is, I think, the most modern classification and in harmony with the latest biological experience.

The species enumerated in this list are all positive identifications and are for the most part the result of the independent observations of Mr. F. L. McKeever, F.R.M.S., and myself. A great many of the collections were made by us jointly, but the microscopical investigations were carried on separately in our own homes. Doubtful species and errors are therefore absolutely eliminated.

The list is as yet woefully incomplete, but I hope in the course of a few years to lengthen it to a great extent.

AN EXAMPLE OF GRAVITY DEFORMATION IN A LIMESTONE SLAB.

By E. M. KINDLE.

It is probably not generally known that cemeteries sometimes afford important data concerning the modification of certain physical characters of gravestones which may take place with the lapse of time. In the erection of monuments the conditions for highly instructive experiments have been sometimes unconsciously prepared. It is the purpose of these notes to record the results of one of these fortuitous experiments in which gravity has produced deformation.

Numerous examples occur in nature of the deformation of consolidated rocks produced by lateral pressure and gravity combined; but no recorded cases of deformation produced by gravity alone under natural conditions have come under the writer's notice. In the experiments of Daubree¹, Townsend², Adams³, and others, the great changes in shape which can be produced in hard rocks and metals by pressure have been shown, but experiments in which gravity alone is the active factor in deformation have apparently been neglected because of the length of time required. Experiments aiming to produce rock deformation by the action of gravity alone appear to have been undertaken only in the case of ice.⁴

Examples may occasionally be found in cemeteries which give some definite information regarding the amount of flexing which may result through the action of gravity alone. Such cases are worthy of record because they afford data on a phase of rock deformation which can hardly be approached experimentally, because of the time required.

(1) *Etudes Synthetiques de Geologie Experimentale*, 1879.

(2) *Jour. Franklin Inst.*, Mar. 1878.

(3) *Geol. Soc. of Am. Bull.*, Vol. 12, pp. 455-461.

(4) Von Engel, O.D., *Experimental Studies and Observations on Ice Structure*, *Am. Jour. of Sci.*, 4th. ser., Vol. 40, pp. 459-460, fig. 7. R. S. Tarr and O. D. von Engel, *Experimental Studies of Ice with reference to Glacier Structure and Motion*, pp. 82-139, fig. 9. *Zeitschrift fur Gletscherkunde*. Bd. 1x, 1915.

King⁵, Ashley⁶, and the writer⁷, have described examples of permanent flexing in marble slabs which have been supported by the ends. Becker⁸, has noted in old buildings such as the Alhambra "slabs of rock very much bent by end pressures acting for hundreds of years."

Previously recorded observations on deformation in cemetery monuments all refer, with one exception, so far as the writer is aware, to marble slabs. The exception, if it may be so termed, is described by Winslow⁹ as a white crystalline limestone or marble.

It is purposed to call attention here to the case of a limestone slab covering a grave in a cemetery in Hull, P.Q. In the example under consideration the stone is an unaltered limestone of Trenton age as indicated by the fossils which it contains.

During the early history of the Ottawa Valley slabs of Trenton limestone were sometimes used for monuments in the local cemeteries. In the Hull cemetery there is a slab of Trenton limestone over one of the first graves made in this cemetery which is supported on two upright stones placed under the two ends, the middle portion of the slab being subject to gravitational pull without any support. This has developed in the middle portion of the slab a sag amounting to 1½ inches. The general appearance of this slab is shown in the accompanying photograph (Fig. 1). This slab has a length of 6 ft. 6 in., a width of 2 ft. 10½ in. and a thickness of 3¾ in. The inscription on the face of the stone indicates that it was placed in position in 1844 or a little later. The deformation which this slab of Trenton limestone has suffered has been developed therefore during a time interval of not more than 77 years.

(5) *U. S. Geol. Exp.*, 40th. Par., Vol. I, p. 752.

(6) *Proc. Cal. Acad. Sci.*, Vol. 3, 2nd. ser., 1890-92 (1893) pp. 319-324.

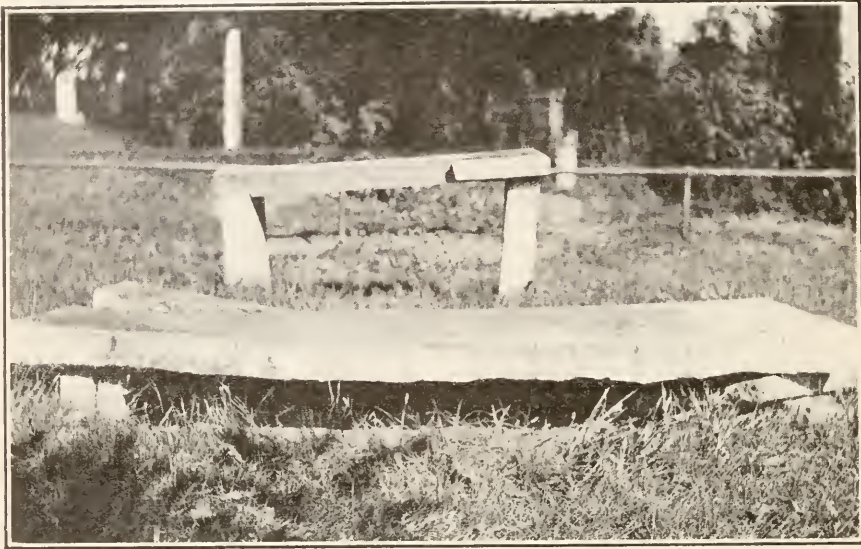
(7) *Proc. Ind. Acad. Sci.*, 1894, pp. 49-50.

(8) *Geol. Soc. of Am. Bull.*, Vol. IV, 1893, p. 53.

(9) *Am. Jour. Sci.*, Vol. 43, 1892, pp. 133-134.

This slab, with its curved surface, may be considered to represent an arc of a circle which, if completed, would have a diameter of 85 feet. In other words, a slab of Trenton limestone $3\frac{3}{4}$ inches thick

and 266 feet in length could in a period of 75 years or less be bent into a circle if subjected to a stress no greater than its own weight.



THE TREATMENT OF SKIN IRRITATIONS DUE TO POISON IVY.

The excessive heat of last summer, causing profuse activities of the pores of the skin, was to a measure responsible for the large number of cutaneous inflammations produced by poison ivy. Persons who had never before experienced the effects of poison ivy succumbed to attacks this year, and the usual feeling of security by persons considering themselves "immune" was largely lost. Observations for a period of years lead me to believe that no person is permanently immune, unless he succeeds in avoiding contact altogether. On the contrary, people who heretofore were never bothered by the effects of this plant, and who claimed to be quite immune, became violently affected when in a state of profuse transpiration.

The name poison ivy is well known — and scores of harmless plants are carefully avoided by the camper or picnicker. It is remarkable how few people do actually know and recognize the plant. All have some idea, mainly the wrong one, until they experience the effect on their own

skin of having come into actual contact. Where there is rocky ground or pure sand beaches bordering woods, where pines and ash grow, there is it necessary to survey the ground for this bane of outdoor life. Remember the three leaves of poison ivy, which distinguish it readily from the five-leaved Virginia creeper which it resembles. In fall the leaves turn golden brown to bright red and are not infrequently gathered for their glory by the unsuspecting. Beware! Beyond the beauty lurks the beast, and skin inflammations are sure to follow indiscretion. One would expect that people would be familiar with the appearance of such irritation, but only those actually affected remember the symptoms; indeed, often enough poison ivy rash is not recognized by the learned professions. Invariably children are the victims. Picking berries, roaming among the brambles, their naked feet covered with harmless minute scratches; their energy excites their spores to increased activity — and from a few hours to a few days after, there appear the

first symptoms of poison ivy injury, at first merely a redness, irritable and itching, slightly raised above the normal skin, bordering pricks and scratches — followed by a few watery blisters, containing a cloudy serous liquid; finally intense irritation, numerous blisters, and oozing inflamed patches are the result. The ooze is conveyed to other parts of the body; eyelids, lips, neck, etc., become involved, and the discomfort is great. Children will scratch the blisters open, and in severe cases there is loss of sleep and appetite.

The plant comes in for considerable blame anyway, but superstition and incorrect or inadequate observations have given rise to tales of: "once infected, the infection lasts seven years; it recurs every year! in fact it is almost hopeless!" This assumption is really nonsense. Yet one comes across such comments often enough in textbooks which should really know better. Poison ivy irritations are acute in the first place; none of the many children and grown-ups whom I have made it my business to watch have ever shown recurrence without re-infection. If skin troubles recur, they were not originally due to poison ivy. Yet there may be some truth apparently in the assumption that actual contact is not necessary. I doubt this, however, from mere lack of positive evidence. Nobody, of course, ever comes knowingly into contact with poison ivy. One such case is known to me, where afterwards I found a vase full of glorious fall-tinged poison ivy in the house — with two of the inmates suffering from a persistent "heat rash", with the usual poison ivy symptoms.

Not until one of my own children afforded me material for study and experiment did I become interested in the treatment of poison ivy. At first — as usual — every possible thing was tried, even medical opinions were sought. Pet remedies which everybody seems to possess were equally uselessly employed. Baking powder, sour milk, sulphur soap, lead water, lead acetate, boracic powder and lotion, calamine lotion, potass. permanganate, fatty and alcoholic substances, extracts of *Grindelia*, the fresh juice of *Impatiens*, were tried one after the other and results noted. None of these substances is a cur-

ative; some eased the irritation for a moment, others caused profuse oozing. The child was productive of wonderful patches until her shins were covered with one oozing, beady sore, 2 inches wide and 8 inches long. The usual precautions were taken. The child was not allowed to swim in the river, was cautioned and occasionally effectively prevented from scratching, but the dose of ivy poisoning persisted until the following treatment was resorted to. The oozing sores were washed perfectly clean with soap and water, followed by dubbing with 95 per cent alcohol — which latter did no good — but the sores were then dried with a clean absorbent towel and were painted over from one to three times with a cotton wool plug dipped into Tincture of Iodine — the usual B. P. tincture — although later on in cases of adults the Churchill tincture was often used. This application caused profuse oozing, and the ooze was absorbed by dusting with boracic acid powder. The application of the iodine tincture did not cause any pain other than that resulting from the actual mechanical touch. The smaller sores were treated just the same. After 24 hours most of the iodine stains had disappeared. The skin was again washed as before with soap and water, dried, and a second application was made, followed 6 hours later by a third. Careful attention was paid to any possible signs of iodine poisoning, such as redness or burns, or any effects from absorption of the drug, which is known to occur in certain individuals, but no untoward complication became noticeable, and the patches healed up, most of the minor ones after one good application, i. e. allowing the first to dry and painting again until a good deep-yellow, yet still light brown stain resulted. The sores on the shins had healed up after a week — three applications of tincture of iodine sufficed. During all this time the child was permitted to go in bathing with the rest of the children, without any ill effect to her or the others. The preliminary treatments, as described before the iodine was resorted to, are not necessary, as further experiments and observations proved. In not a single case of poisoning with poison ivy did I observe failure or ill effects, and a good

many have been kept under observation during the last three years.

In case there should result any skin irritation from the application of Iodine, an application of a starch poultice might be resorted to. Should any person fear the application of Iodine, it is suggested that it be not resorted to until the treatment is authorized by one's medical adviser.

In conclusion a word may be said about the eradication of this undesirable plant. Poison ivy will not be killed by a single cutting, as new shoots or suckers are persistently sent up from the root stocks. The root stocks must be exhausted by destroying the foliage as fast as it appears, either by repeated mowing or by spraying with a strong salt brine made at the rate of 3

pounds of common salt per gallon of water. If the weed is cut or sprayed in June and the treatment repeated about three times at intervals of 10 days or two weeks, the root stocks will become exhausted and die. Arsenate of soda (a violent poison), $\frac{1}{4}$ pound per gallon of water, or crude oil may be substituted for the salt spray. Spraying does not affect the roots directly, but is simply equivalent to cutting. However there is the advantage that one need not come into actual contact with the plant. Spraying with one pound of caustic soda dissolved in two gallons of water has been found very effective.

H. T. Gussow,

Experimental Farm, Ottawa.

NOTES ON THE NORTHWEST COAST HERON IN STANLEY PARK, VANCOUVER, B.C.

Having on numerous occasions seen herons flying over the City of Vancouver I had unsuccessfully endeavored to discover their nesting site, and was much pleased to hear, on June 9th last, that a number of herons were nesting in Stanley Park. Without delay and in company with two friends I visited the Park, and not far from Brockton Point found the heronry. It was situated in a very heavily timbered corner and the main nesting site was in a large spruce tree, this tree being about 250 ft. in height. We counted thirty-seven nests in this single tree, and about fifteen young birds were in view, either sitting up in the nests or perched on the branches of the tree. The young, which appeared to be half or three-quarters grown, kept up an incessant squawking, which increased fourfold whenever a parent bird appeared with food. The branches of this spruce tree, except for their tips, were devoid of foliage, and tree trunk, branches and nests were of a greyish-white colour from the birds' droppings. Much of the vegetation close to the ground under the tree was dead and everywhere the ground was littered with pieces of egg shells, filth, etc. I secured a number of egg shells, some of which were in excellent condition. Two nests and five young dead birds were

found on the ground beneath the tree; two of these were about half grown, two about three weeks old, and the fifth about one week or ten days old. All five birds were more or less decomposed. These nests with the young had, no doubt, been blown down by a recent heavy wind and rain storm. One nest was complete and unbroken, and proved to be a bulky affair and of solid construction, the outer part being constructed of coarse branches about half an inch in diameter, while the inside was well made with fine twigs securely plastered together with refuse and excreta from the young birds. From the size, the nest must have been in use several years, each year having had a little added to it. It was between three and four feet in diameter outside, while the bowl measured eleven inches wide by five inches deep; the whole nest was of a greyish-white colour as if it had been whitewashed. Under the tree three lampreys were found, having, no doubt, been dropped by the birds when feeding; two of these fish measured $7\frac{1}{2}$ inches and one $9\frac{1}{2}$ inches, two were minus heads and the other lacked its tail. Several photographs were taken by one of my companions, Mr. Abbott, and in these the young birds can easily be distinguished.

About two hours were spent watching

these herons and during that period about twelve adult birds visited the tree with food



for the young. After feeding them they would sometimes rest for five or ten minutes before leaving again for their fishing grounds. Many of the young, which I estimated to number from sixty to eighty, constantly stood upright and exercised their wings back and forth. Two other nesting trees were close by and on these also young birds were noticed.

On June 13th the heronry was again visited and another nest was found on the ground. It contained three half-grown birds, all so badly fly-blown that I was unable to preserve them. One bird was weighed and scaled three pounds. Its iris was pale lemon-yellow; lower mandible yellow with upper edge dark horn colour; upper mandible, dark; upper part of tarsus sulphurous yellow with greenish cast, the balance of tarsus and toes dull bluish-grey; claws very dark. The bill measured at culmen 3.00 in., at gap 4.56 in., tarsus 4.50 in.

Several more photographs were taken. Thirty-six nests could be seen distinctly, and these, with the three found on the ground, made a total of thirty-nine nests in this particular tree. On June 9th five

dead birds were found, and on the 13th another small one was located behind a log; it had been dead for a long time and was, no doubt, out of one of the two first nests found. About thirty-five young birds were in view on the 13th and careful scrutiny failed to reveal more than three birds in any one nest, the majority being two to each nest, while a few held but a single young bird. A fair estimate would place the number of adult breeding birds at from fifty to sixty. The parent birds who hunt for food along the shores of Burrard Inlet, Kitsilano, Point Grey and Sea and Lulu Islands only feed the young at long intervals.

A bald eagle was seen to approach the nests, when suddenly many of the old birds appeared from every direction and quickly drove away the unwelcome visitor.

At the time of writing, July 23rd, many of the young birds are flying, but return every night to the nesting tree. These herons fly at all hours of the night, and I very frequently hear them croaking to one another between the hours of ten and twelve at night, as they fly far overhead towards the Park.

The Stanley Park Heronry has during the past few weeks become one of the points of interest in the Park, and hundreds of residents of this city as well as visitors now stop to have a look at the curious bird colony, none of the members of which appear to be in the least disturbed, however many people gather about to watch them.

K. RACEY, 3262 First Ave. W.,
Vancouver.

BIRD CENSUS FROM LONDON, ONT.

BY E. M. S. DALE.

President, McIlwraith Ornithological Club.

For some years our Club has sent in reports to the "Bird Lore" Christmas census. The number of species observed has increased from seven in 1910 until now a limit seems to have been reached of some nineteen or twenty. This probably does not indicate more birds here during recent years, but rather growing efficiency on the part of a larger company of observers, combined with increased knowledge of the localities most favored by the birds in winter. It may be interesting to readers of the *Canadian Field Naturalist* to compare these lists which are annexed hereto in tabulated form.

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Horned Grebe.....								1			
Herring Gull.....				1				3	2		
American Merganser...	15				22		2	20			2
Lesser Scaup.....				1							
American Goldeneye...					2			10			1
Ruffed Grouse.....				1		1		2			
Marsh Hawk.....							1				
Cooper's Hawk.....				1							
Red-Shouldered Hawk...											1
Sparrow Hawk.....									1		
Long-eared Owl.....										1	
Screech Owl.....						1		1			
Great Horned Owl.....								1			1
Kingfisher.....		1		1		1	1				1
Hairy Woodpecker.....			1				2	1	2		3
Downy Woodpecker...			2		1	3	10	6	7	8	8
Bluejay.....		2		1	1	3	3	10	3	10	8
Crow.....	57	3	1	19	10	2500	312	1500	30	22	11
Redwinged Blackbird...			1								
Pine Grosbeak.....	3										
Purple Finch.....					1	15	15	50		2	
American Crossbill.....									5		
Redpoll.....				3			45			55	
Goldfinch.....			1						1	1	
Pine Siskin.....										65	
Snowbird.....							100			20	5
Tree Sparrow.....		2			30	2	22	18	3	15	27
Junco.....	3	3	10	20	15	2	28	15	20		72
Song Sparrow.....					3		2	1	1	3	5
Cardinal.....							7	1	1	3	4
Northern Shrike.....			1				1	1	1		
Brown Creeper.....	1			5	1	2	7	4	5	7	2
Red-breasted Nuthatch			1		1					1	
White-breasted "		1	3	5	6	4	10	4	10	7	3
Blk.-capped Chickadee...	6	9	6	28	5	25	78	42	39	87	26
Brown-capped "										1	
Golden-crowned Kinglet	10	1	2	4	7	2	10	12	2	15	27
Robin.....			2						1		
TOTAL INDIVIDUALS	7sp. 95	8sp. 22	12sp. 31	13sp. 90	14sp. 105	13sp. 2561	19sp. 656	21sp. 1703	18sp. 134	18sp. 323	18sp. 207

NOTES AND OBSERVATIONS.

UNUSUAL MIGRATION RECORDS IN THE VICINITY OF MONTREAL—MARCH 1921.

No doubt the mild weather during the past winter, and the abundance of fruit and seeds (especially coniferous seeds) limited the movements of a great many Northern birds. Throughout South-Eastern Canada and the North-Eastern States, at least in urban districts, the dearth of birds appears to have been general. Of the

eustomary winter birds the following were seen in the vicinity of Montreal in very small numbers: Snowy Owl (2); Saw-whet Owl (2); Hairy and Downy Woodpeckers; Snow Bunting; White-winged Crossbill; Pine Siskin; Goldfinch; Redpoll; Cedar Waxwing; White-breasted Nuthatch; Red-breasted Nuthatch; Black-capped Chickadee.

The unusual occurrences were: Herring



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A PRELIMINARY SURVEY OF THE BIOTA OF A SAND SPIT IN LAKE WINNIPEG.

By CHAS. H. O'DONOGHUE, D.Sc., F.Z.S.

Professor of Zoology, University of Manitoba.

Early in July, 1918, I was enabled to make a short stay of eight days on Berens Island, Lake Winnipeg, through the courtesy of the Riverton Fish Company of Riverton, Man. I was accompanied by J. Nelson Gowanlock, B.A., Fellow in Zoology in the University of Manitoba, and we both desire to express our thanks to the company for a round trip of some 500 miles from Hnausa, taking in Berens Island, and also to the men at the fishing camp at Swampy Harbour for many favours.

The main object of the trip was to become acquainted with the general life conditions in the great tree belt of the "Canadian zone" which occupies such a large part of the Province of Manitoba. To this end a camping site was chosen on Berens Island which is situated well within that region and, save for a small corner, has not been interfered with by settlement. Further, the journey there and back allowed of short visits to a number of typical and practically undisturbed spots.

Adams (1) points out that for satisfactory ecological study only "repeated and prolonged visits, careful observations, and descriptions of the place and animals will enable one to acquire the desired familiarity." This was obviously impossible in a short stay, but the whole area was so full of interest that it seemed highly desirable to call attention to its possibilities, and, further, it was hoped that opportunities would occur later to revisit the spot or perhaps induce other people to do so and continue the work in a more satisfactory manner. This hope has not been realised, and the present paper makes no pretence at completeness but is intended to serve as an introductory survey.

The following notes relate particularly to a sketch of the life conditions on a sand

spit of Berens Island. Similar spits occur at other places on the lake, but, so far as I know, none combine so fully two important considerations, namely accessibility and, at the same time, almost complete freedom from human interference. In Shelford's terms it is a "primeval or primary community" (7). Press of work has prevented their publication at an earlier date. It is hoped, however, that they will be of some interest and serve to call attention, *inter alia*, to the fact that practically no ecological studies have been carried out on the islands and shores of freshwater lakes in Northern Canada where the conditions differ greatly from those farther south.

Berens Island is one of the two large islands in the northern part of Lake Winnipeg and lies approximately in latitude 52 deg. 15 min. N. and longitude 97 deg. 15 min. W. Its greatest length is eight miles and its greatest width four. The north-west sandy shore stretches in a very shallow curve for about seven and a half miles and faces the north-west corner of the lake which is over 120 miles away. The remaining part of the coast is more indented and rocky and has a large rounded projection on the south corner. As is well known the eastern and western shores of Lake Winnipeg differ markedly in character owing to the nature of the formation on which they lie. The former is composed of the Laurentian rocks, and the latter of Cambro-Silurian and a certain amount of alluvial drift. Although the island lies nearer the eastern than the western shore, it is nevertheless inside the limits of the Cambro-Silurian but must lie very near the junction between the two. The island is well within the limits of the Canadian zone and its characteristic trees are the Spruce, *Picea mariana*, and the Tamarack, *Larix laricina*,

with one or two clumps of Silver Birch, *Betula alba* var. *papyrifera*, and groups of *Populus balsamifera*. It includes, at any rate, one large grass swamp and much muskeg, and is similar to most other islands in the lake. The climate is typical of that of the surrounding region, dry, much of the precipitation taking the form of snow in the fairly long winter. The lake all around is frozen for 5 months or so and the temperature may drop to -40 deg. F. or sometimes lower.

The southern portion of the north-west coast for $2-2\frac{1}{2}$ miles is formed by a large spit of land continuing the general line of the coast and only separated from

a well-wooded island known as Burton or Little Black Island by a narrow channel 30-40 yards wide. This main spit, therefore, includes between it and the south end of the island a large wide open bay. The spit is composed mainly of sand which on its western side takes the form of dunes rising fairly rapidly from the water but sloping more gradually on the eastern side. Near the main island the dunes are 15 to 20 feet high but the last part of the spit is almost flat. From the east side of the main spit two smaller spits are given off. The one nearer to the island runs first almost east then north-east and finally almost north back towards the island and

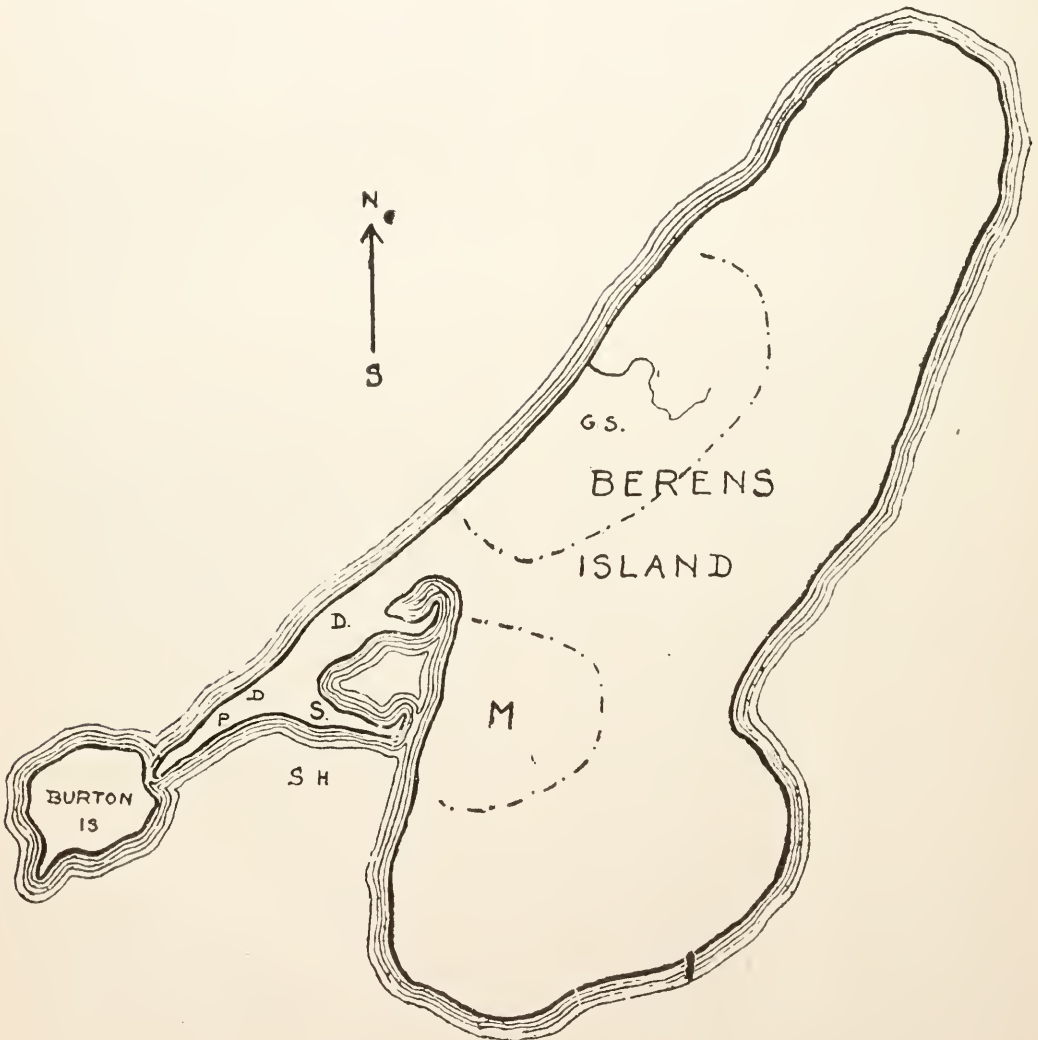


Fig. 1. — Rough sketch map of Berens Island. D, Dune area; G. S., large grass and reed swamp; M, muskeg; S, the spit on which the camp was pitched and the collections made; S. H. Swampy Harbour.

so encloses a sheet of water 150—200 yards wide and 200-300 long. The one farther from the island runs almost due east for nearly 500 yards and gives off at its extremity another smaller spit about 170 yards long pointing to the north. This second spit, therefore, encloses a still larger bay which includes the former spit, and this bay and its eastern end come over to within about $\frac{1}{2}$ mile of the southern extremity of the island. In this way there is formed a very good harbour known to the fishermen as Swampy Harbour and for this reason the whole island is sometimes erroneously referred to as Swampy Island.

The main ridge and its side spits form an environmental complex that is in many ways similar to that on the shores of Lake Michigan in the vicinity of Waukegan, and its biota (total life content both animal and plant) must be on the whole fairly similar save for the effects of its more northern position and the somewhat different forest associations with which it is surrounded.

The observations were made on this second spit which has the form of an L and may be treated as a small ecological unit. Its long stem coming off from the main spit runs east by a trifle south, and is about 500 yards long by 100 yards wide. On each side it slopes off very gradually under the water, on the north to the inner bay and on the south to the outer bay. It has three crests running along it, the highest of which is about $7\frac{1}{2}$ feet high and lies near the southern side. The short stem of the L is about 170 yards long by 23 yards wide and runs north by a trifle east. On the west side of this the water (of the inner bay) is very shallow, but on the east side it is deeper, particularly at the heel of the L, so that the fisheries steamer "*Lady of the Lake*" is able to run alongside a very short pier. At this point are the cleaning shed, the store house, bunk house and cook house used in both summer and winter fisheries by about a dozen men. The short stem of the L is used for work on the nets and boats, etc., and is sandy without any vegetation. Our own camp was pitched about half way along the spit. It is quite obvious that the spit is much younger than the main ridge from which it springs, for while the latter has several groups of fair-sized poplars, *Populus balsamifera*, the former has only much smaller ones, and

the largest of these occur at the place where it comes off the main stem. It therefore represents a comparatively recently formed spit of sand and fine shingle that is being established and overgrown by vegetation.

The most striking feature is the manner in which the plants are arranged in rows parallel with the axis of the spit, each row characterised by the presence of a particular species or group of species. On standing at either end and looking along the spit this cannot fail to be remarked, for it almost looks as if it were arranged and was commented on by two of the fishermen quite independently. About eleven of these zones can fairly readily be distinguished and may be named according to the prominent vegetation characterising them. Thus, starting on the south, we have:—

- A 23 feet shore sand zone
- B 21 " zone of soft sand
- C 25 " artemisia zone
- D 29 " vetch zone
- E 28 " golden-rod zone
- F 25 " rose zone
- G 31 " astragalus zone
- H 21 " second vetch zone
- J 45 " willow and poplar zone
- K 13 " grass zone
- L 40 " shore sand zone

To which may be added

- M the water zone on the inner side.

The grasses extend through nearly all the zones, but in K they are very close and are the only noticeable plants; they form the main part of the vegetation of zone J. The two shore zones are partly covered when the water is high, and were probably submerged in 1916 and 1917 when the whole lake level was slightly higher than in 1918.

The following table gives an idea of the zonation. It provides a list of the plants found and the zones in which they were distributed. To convey some idea of the amount of vegetation present, letters have been employed. They are by no means accurate, but time was too short to allow of taking unit counts. Thus "extremely common" means that the area was well covered with the species and n. e. means that examples only occurred here and there, often as stragglers from the next zone. "Rare" is meant to indicate that only a few specimens occurred on the whole length

PLANTS		ZONES										
FAMILY	SPECIES	C	D	E	F	G	H	J	K	L	M	
Equisetaceae	<i>Equisetum arvense</i> L.....	r		nc	r	r		ec	r			
Najadaceae	<i>Potamogeton interior</i> Rydb.....										vc	
	" <i>richardsonii</i> " ..										nc	
Gramineae	<i>Alopecurus pratensis</i> L.....							r		ec		
	<i>Calamagrostis canadensis</i> [Michx. Beauv.]	nc	nc		nc							
	<i>Deschampsia caespitosa</i> "	c		c	c	r						
	<i>Hordeum jubatum</i> L.....		nc	r				nc	ec	c		
	<i>Poa triflora</i> Gilib.....		nc	r								
Cyperaceæ	<i>Carex aquatilis</i> Wahlenb.....							r		ec		
	" <i>bebbii</i> Olney.....	nc		c	nc			c				
	" <i>viridula</i> Michx.....							nc				
	<i>Eleocharis acicularis</i> L.....							r		ec	vc	
	" <i>palustris</i> L.....							c		ec	nc	
Lemnaceæ	<i>Lemna trisulca</i> L.....										r	
Juncaceæ	<i>Juncus balticus</i> Willd. var. [littoralis ..]							r	c	ec	r	
Salicaceæ	<i>Populus balsamifera</i> L.....			nc	nc			c				
	<i>Salix candida</i> Flugge.....							nc	nc	nc		
	" <i>discolor</i> Muhl.....	nc			nc			nc	nc	nc		
	" <i>longifolia</i> Muhl.....	nc			nc	r						
	" <i>lucida</i> Muhl.....	nc			nc			nc	nc	nc		
	" <i>peltita</i> Anders.....		nc					nc				
Urticaceæ	<i>Ulmus americana</i> L.								r(1)			
Polygonaceæ	<i>Polygonum aviculare</i> L.....									nc	vc	
	" <i>Persicaria</i> L.....									nc		
Chenopodiaceæ	<i>Chenopodium album</i> L.....									nc		
Caryophyllaceæ	<i>Stellaria longipes</i> Goldie.....				r			nc				
Ranunculaceæ	<i>Anemone canadensis</i>							r	nc			
	<i>Ranunculus flammula</i> L. var. [reptans Mey.. ..]								nc			
	" <i>macounii</i> Brit.....								nc			
Rosaceæ	<i>Fragaria vesca</i> L.....			nc	nc			vc	nc			
	<i>Potentilla Anserina</i> L.....			nc						nc		
	" <i>rivalis</i> Nutt. var. [pentandra Wats.]							c	r			
	<i>Rosa blanda</i> Ait.....	r		nc	ec	r	nc					

PLANTS			ZONES									
FAMILY	SPECIES	C	D	E	F	G	H	J	K	L	M	
	<i>Rubus idæus</i> L. var. <i>strigosus</i> [Max.			r	nc							
Leguminosæ	<i>Australagus aboriginorum</i> Rich.	r	r	nc	nc	ec	nc	r				
	<i>Lathyrus maritimus</i> L.	r	nc				nc					
	<i>Vicia americana</i> Muhl.		ve	c	c		nc	ve				
Anacardiaceæ	<i>Rhus glabra</i> L.				r(4)							
Onagraceæ	<i>Oenothera biennis</i> L.				nc	r	nc		r			
	" sp.				r		nc					
Haloragidaceæ	<i>Myriophyllum spicatum</i> L.										nc	
Umbelliferae	<i>Sium cicutæfolium</i> Schr.			c	nc			c	r			
Cornaceæ	<i>Cornus stolonifera</i> Michx.	r(1)	r(1)	r(1)				r(1)				
Labiatae	<i>Mentha arvensis</i> L. var. <i>cana-</i> [<i>densis</i> Bri.								nc			
Compositæ	<i>Achillea millefolium</i> L.			nc								
	<i>Artemisia caudata</i> Michx.	nc	nc		nc	c	c					
	<i>Solidago canadensis</i> L.		nc	ec	c			nc				
	" sp.		nc	c	nc			nc	nc			

ec extremely common. ve very common. c common. nc not common.
r rare.

of the zone. It will be obvious, of course, that the term "very common" has quite a different value in numbers of plants to a unit area when applied to say roses and grass.

The plants were kindly identified for me by Mr. C. W. Lowe of Winnipeg.

The foregoing list is typical of the flora of sandy areas in the region of Lake Winnipeg with perhaps the possible exception of *Astralagus aboriginorum*. This does not appear to be common in the province and is listed by Rydberg (6) as a mountainous or sub-mountainous species and is not stated to occur in the province by Gray (2).

While it is true that on the whole the zonation is striking in its regularity, there are two noteworthy exceptions. Firstly, at the east end in the neighborhood of the camp which has been used both in summer and winter for some years, the zones are mixed. There are one or two old camp

sites and frequently dog teams are tethered at this point. Apart from this, however, there is a large clump of willows extending across several zones and these give shelter to plants — *Anemone canadensis*, *Achillea millefolium*, *Rubus idæus* var. *strigosus* and *Fragaria vesca* — not at all common elsewhere.

Secondly, at the end where the spit joins the main ridge there is a transverse ridge of limestone pebbles which are overgrown with lichens, including *Cladonia pyxidata*, and are obviously older than the remaining part of the ridge. Among the pebbles, remains of a few Ammonites (*) were found but they were too worn and broken to be identified. This partly juts into the daughter spit, noticeably at zone H, and partly also at G and K, and the west end of these zones include part of the zonation of the main ridge. The plants here, *Popu-*

* These appear to be *Maclurea* and perhaps *M. Manitobaensis*.

men are camping there they have one or more dog teams about.

Family Sciuridae.

No actual specimen was taken or seen but near the camp were tracks which I think belonged to:—

Sciurus hudsonicus Erxleben.

Citellus franklini Sabine.

Family Muridae.

Peromyscus maniculatus arcticus. Mearns, the arctic deer mouse. Two specimens were taken at the camp.

One of the fishermen reported having seen a ground squirrel — presumably *Citellus franklini* — and the mouse was not uncommon.

On the main island tracks of the lynx, *Lynx canadensis*, and the fox, *Vulpes fulva*, were encountered, but not on the spit, and one evening a timber wolf, *Canis occidentalis*, was seen on the island opposite the spit.

CLASS AVES.

Somewhat fuller notes are provided in the case of the birds since Mr. J. N. Gowanlock was particularly interested in them. I here wish to express my thanks to him for his assistance in this matter. The numbers are those of the *Catalogue of Canadian Birds*. (5)

ORDER LONGIPENNES.

Family Laridae.

(51.) *Larus argentatus* Pontoppidan, Herring Gull. A common visitant fishing along the shores of the spit. Groups sometimes alighted to sun themselves along the southern side.

(54.) *Larus delawarensis* Ord. Ring-billed Gull. Associated with but in lesser numbers than the preceding.

(64.) *Sterna caspia* Pallas, Caspian Tern. The nearest breeding-place of these birds was on Pelican Island and on only two or three occasions were individuals (in one instance a dozen or more) observed passing over the spit in company with the two following species.

(69.) *Sterna forsteri* Nuttall. Forster's Tern. Constantly in search of fish, these birds occurred along the waters bordering the sandspit.

(70.) *Sterna hirundo* Linnaeus. Common Tern. Like the last, this bird fished regularly along the shores of the sandspit,

lus balsamifera, *Equisetum arvense* and some grasses, seem to be invading the daughter spit.

The whole spit is exposed and the plants not so advanced as in more sheltered parts. Thus while roses, *Rosa blanda*, were in flower on Big Island on July 5th, the first one to come out on the spit was on July 10th. Again, ripe strawberries were common on Big Island on the same day but did not ripen plentifully on the spit until July 12th. It is, of course, not protected by trees and so exposed to the winds; this was a decided advantage, for the camp was practically free from the mosquitoes which are such a pest on the main part of the island.

One of the most striking features in the distribution of the plants is that on each side we have zones that are well covered with plants, i.e. D, E and F on the south and J and K on the north, while G and H between them are very sparse indeed. If we rule out the invasion at the west end and the poplar clumps at the east they are almost bare. B in particular is sandy and has all along it a line of drift showing that within the last few years it was the shore of the inner bay. Drift is also found on the inner side of H.

ANIMAL LIFE.

As might be expected the animal life on such an area is not extensive, but a number of different forms were taken.

While an attempt was made to identify the specimens and a number were actually identified, I soon realised that in the absence of ready access to a large library and well stocked museum, the task could not be satisfactorily accomplished. I therefore threw myself on the generosity of my fellow-scientists who, without exception, gave me their assistance. In each case I have cited the authorities responsible for the determination of the species. The United States National Museum, Washington, through the kind offices of Dr. Aldrich were good enough to identify many of the insects, and the name of the particular expert, followed by U. S. Nat. Mus., is associated with the forms they determined.

CLASS MAMMALIA.

Mammals were rare on the point, perhaps owing to the fact that whenever the

especially over the shallower waters of the inner bay.

ORDER STEGANOPODES.

Family Phalacrocoracidae.

(119.) *Phalacrocorax auritus auritus* Lesson. Double-crested Cormorant. Noted once, flying over the sandspit, three individuals in company with ducks.

Family Pelecanidae.

(125.) *Pelecanus erythrorhynchos* Gmelin. White Pelican. From one to eight or more of these birds fished partically every morning and evening in the inner bay and on one occasion one was encountered on the spit itself three-quarters of the way to the fish-station.

ORDER ANSERES.

Family Anatidae.

(132.) *Anas platyrhynchos* Linnaeus Mallard.

(139.) *Nettion carolinense* Gmelin Green-winged Teal.

(140.) *Querquedula discors* Linnaeus Blue-winged Teal.

These three species were frequently noted passing in flight over the spit, especially at evening.

(149.) *Marila affinis*, Eyton, Lesser Scaup Duck. A few seen in the evenings a short distance from shore.

ORDER PALUDICOLAE.

Family Rallidae.

(214.) *Porzana carolina* Linnaeus. Sora Rail. The characteristic notes of this rail were heard at the marshy portion of the spit toward Plover Point.

ORDER LIMICOLAE.

Family Scolopacidae.

(239.) *Pisobia maculata* Vieillot. Pectoral Sandpiper. Noted several times feeding along the beaches of the spit.

(254.) *Totanus melanoleucus* Gmelin Greater Yellow-legs. Noted on the spit.

(256.) *Helodramus solitarius solitarius* Wilson. Noted quite regularly along the inner shore of the sandspit, especially in the evening.

(263.) *Actitis macularia* Linnaeus. Spotted Sandpiper. Noted several times on the beaches of the spit.

Family Charadriidae.

(273.) *Oxyechus vociferus* Linnaeus. Killdeer. Noted feeding along the beaches of the spit.

(277.) *Aegialitis meloda* Ord. Piping Plover. Noted one morning along the outer beach. Nested at Plover Point, where parents and young were collected.

ORDER RAPTORES.

Family Buteonidae.

(331.) *Circus hudsonius* Linnaeus. Marsh Hawk. Observed passing over point several times and on one occasion it was noted quattering near the camp in search of prey.

ORDER COCCYGES.

Family Alcedinidae.

(390.) *Ceryle alcyon* Linnaeus. Belted Kingfisher. This conspicuous bird was a rather infrequent fisher along the inner shoreline of the sandspit.

ORDER MACROCHIRES.

Family Caprimulgidae.

(420.) *Chordeiles virginianus* subsp. Gmelin. Nighthawk. This species was a regular visitor on the spit near camp at evening, a half a dozen or more being noted or heard at one time.

ORDER PASSERES.

Family Coraciidae.

(488.) *Corvus brachyrhynchos brachyrhynchos* Brehm. Crow. Flocks composed of as many as a hundred individuals regularly visited the beaches of the sandspit in search of dead fish. Single individuals could be observed in the vicinity at almost any hour of the day but the large flocks usually came at evening and morning.

Family Icteridae.

(495.) *Molothrus ater* Boddaert. Cowbird. Noted as a visitant about the camp.

(497.) *Xanthocephalus xanthocephalus* Bonaparte. Yellow-headed Blackbird. This species was noted several times around camp, usually together with one or both of the following blackbirds.

(498.) *Agelaius phoeniceus* subsp. Linnaeus. Noted as a visitant on the sandspit.

(511b.) *Quiscalus quiscula aeneus* Ridgway. Bronzed Grackle. A common species

on the spit, it probably bred somewhat south of the camp earlier in the season.

Family Fringillidae.

(542). *Passereulus sandwichensis* subsp., Gmelin. Savannah Sparrow. This species was the commonest sparrow on the spit where it appeared to be nesting in the scattered shrubs some distance from camp on the inner shore. At any rate four pairs were actually found nesting on the spit.

(560). *Spizella passerina* Bechstein. Chipping Sparrow. A resident, but not numerous, along the inner face of the sandspit.

(567). *Junco hyemalis* Linnaeus. Slate-coloured Junco. Juncoes were several times noted as visitants to the spit, probably coming from their breeding places across the inner bay.

(581). *Melospiza melodia* subsp. Wilson. Song Sparrow. The Song Sparrow was a resident in fair numbers along the sandspit.

(584). *Melospiza georgiana* Latham. Swamp Sparrow. Noted several times on the spit.

Family Bombycillidae.

(619). *Bombycilla cedrorum* Vieillot. Cedar Waxwing. Flocks of from five to twenty Waxwings very frequently visited the spit. The species did not appear to have begun nesting at this time.

Family Vireonidae.

(624). *Vireosylva olivacea* Linnaeus. Red-eyed Vireo. Widely distributed throughout the whole Lake Winnipeg region, the Red-eyed Vireo frequently visited the spit. It nested commonly across the bay.

Family Mniotiltidae.

(652). *Dendroica aestiva* Gmelin. Yellow Warbler. Resident on the spit; the Yellow Warbler was, however, much less numerous here than on the inner portion of Plover Point.

(657). *Dendroica magnolia* Wilson. Magnolia Warbler. Noted as an infrequent visitant on the spit.

(660). *Dendroica castanea* Wilson. Bay-breasted Warbler. Noted once in shrubs on the spit.

(662). *Dendroica fusca* Müller. Blackburnian Warbler. This species which bred

commonly on other parts of the island was several times observed on the sandpoint.

(675a). *Seiurus noveboracensis notabilis* Ridgway. Grinnell's Water Thrush. Observed frequently feeding singly along the inner shore line.

(687.) *Setophaga ruticilla* Linnaeus. Redstart. A common nesting species across the island, the Redstart was noted several times as a visitant on the sandspit.

Family Sittidae.

(727.) *Sitta carolinensis* subsp. Latham. White-breasted Nuthatch. Observed once or twice on the spit.

Family Paridae.

(735). *Penthestes atricapillus septentrionalis* Harris. Long-tailed Chickadee. A common breeding species in woods across the bay, the Chickadee not infrequently visited the sandspit in its characteristic wanderings.

Other interesting birds were encountered during the trip, some of which have been reported previously (4).

CLASS REPTILIA.

No reptile was actually found on the spit but a larger specimen (about 32 in. long) of the Garter Snake was taken on the main island opposite the end of the spit. So far as I know this is the most northerly point in the province from which this species has been recorded. I should judge that it is by no means common, for, on the news of its capture reaching an Indian camp at the end of the island, the Indians came over and solemnly requested to be shown the snake which some apparently then saw for the first time.

Family Colubridae.

Thamnophis sirtalis parietalis Say.

CLASS AMPHIBIA.

The amphibia were not found as a rule on the spit which was dry, but lived in the damp grass marsh of the main ridge. Often in the evening they would come out on the shore of the spit and the following were taken there.

Family Bufonidae.

Bufo hemiophrys Cope. Quite common.

Family Hylidae

Pseudacris septentrionalis Boulenger. Rare, 1 specimen.

Family Ranidae.

Rana pipiens Schreiber. Not common.

CLASS INSECTA

Insects, while abundant on the island, were not very common on the spit. Unfortunately, time did not allow the taking of satisfactory notes, and also in several instances the preservation was so bad as to prohibit the accurate determination of the species. Some interesting forms were encountered.

ORDER ODONATA

Dragon flies were plentiful on the island but the only species taken on the spit was *Nhalennia icene* Hagen (B.P. Currie, U.S. Nat. Mus.)

ORDER NEUROPTERA

The following were taken on the spit but their faulty preservation did not allow of an accurate identification.

Limnephilidae, 2 species; Phryganea, 1 species; Ephemeridae, 1 species (immature) (A. N. Candel, U. S. Nat. Mus.)

ORDER ORTHOPTERA

A number of grasshoppers were taken but all of them were in an immature condition and all belonged to the genus *Melanoplus*. They were kindly identified for me by Mr. Norman Criddle of Treesbank, Manitoba, as follows:—

Melanoplus atlantis, *M. dawsoni* and *M. femur rubrum* or *angustipennis*.

ORDER HEMIPTERA

The following were taken:

Capsus ater, adult and young; *Nabis* sp. nymph; several specimens of family Corixidae not identified. (W. L. McAtee, Biological Survey, U. S. Nat. Mus.)

ORDER LEPIDOPTERA.

Family Nymphalidae, *Brenthis aphirape* var. *dawsoni*; *Phyciodes tharos* Drury; *Basilarchia dissipus* Godart; *Basilarchia arthemis* Drury var. *lamina* Fab.

Family Papilionidae, *Papilio machaon* (L) var. *aliaska* Scudder.

Family Sphingidae, *Smerinthus cerisyi* Kly.

Family Noctuidae, *Aeronyx* (*Apatela*) *dactylina* Grote; *Hadena allecto*.

Family Notodontidae, *Phaeosia rimosa* Pask.

Family Geometridae, *Rheumaptera hastata* L.

In addition the larvae of *Malasoma fragilis* Stretch and a number of unidentified Noctuids were collected. The stems of a number of the Goldenrods were parasitised by *Gnorioschema gallaesolidoginis* Riley.

ORDER DIPTERA.

The Diptera were kindly identified for me by Dr. J. M. Aldrich of the United States National Museum as follows:—

Tabanus affinis, Kirby; *Tabanus septentrionalis*, Loew; *Maematopota americana*, O. S.; *Chrysops carbonaria*, Walker; *Chrysops lupus*, Whitney; *Sphaerophoria scripta*, L.; *Phormia regina*, Mg.; *Phormia terrae-novae*, R. D.; *Cynomyia cadaverina*, R. D.; *Hylemyia tricho-dactyla*, Rond; *Anthomyia radicum*, L.; *Lispa* sp.; *Spathiophora fascipes*, Beck; *Sciomyza simplex*, Fall; *Camptoprosopella vulgaris*, Fitch; *Dieracus incongruus*, Ald.; *Anarostoma marginata*, Loew; *Fucellia maritima*, Halliday; and a new genus and species of the family Sapromyzidae. The Tipulidae and Chironomidae were not well enough preserved for identification.

Dr. Aldrich has called attention to several interesting forms in the foregoing list.

The fly *Hydrophorus agalma* Wheeler is of considerable interest; it has only been recorded so far from Battle Creek, Mich., the type locality, and from Ridgeway, Ont. It belongs to a very abundant family the Dolichopodidae, whose larval stages have up to the present almost wholly escaped observation. In North America so far the larval stage of only one species, *Thrypticus muhlenbergiae* Johannsen, is known and this is a stem-miner in plants very different from the present species.

The specimens were taken in water only a few inches deep on the north side of the spit where it joined the main ridge. The bottom here is a mixture mainly composed of sand with a little mud, and owing to its sheltered position is practically undisturbed. Unfortunately, owing to lack of time, no satisfactory observations were made on the life history of this form. The larvae build for themselves cocoons of the sand about 8 mm. long and in these also they pupate so that the cocoons collected contained both larvae and pupae. How or

when the flies escape from the cocoons was not ascertained, but from the position they were in it is clear that a slight fall in the level of the lake such as follows a change in the wind or comes naturally in the hot summer weather would leave the cocoons on the dry sand and probably the flies would escape at such a time. This habit of forming sand cocoons is apparently unique, for there is no record in Europe of the early stages of this genus (nor indeed of any other genus forming sand cocoons), and the species would doubtless repay further study.

Spathiophora fascipes Beck, is a European species that has been recorded in North America only from one locality on the shores of Lake Erie and two on Lake Michigan.

Amorostoma marginata Loew, is a form that is very difficult to see. It lives on the bare sand of the dunes of the main ridge and the sandy shore line of the spit. An allied species *A. maculata* lives in a similar habitat at Pacific Grove, California.

Fucellia ma itima Halliday is also of considerable interest since it is normally a sea shore form breeding in decaying seaweeds. It is abundant on the eastern coast of the United States as far south as Cape Hatteras and on the West coast of Europe. While it has been found occasionally inland in Europe, it has only been reported by Malloch from Waukegan, Ill., on Lake Michigan, and the United States National Museum until now had no specimens from any inland water. It is to be noted that the sand beaches of this area are very similar to the spit on which the species was taken.

Four specimens of a Sapromyzid fly were taken, which Dr. Aldrich informs me belong to a new genus and new species that he hopes he will be able to describe shortly.

ORDER COLEOPTERA.

The Coleoptera were kindly identified for me by Mr. J. B. Wallis, of Winnipeg, as follows:—

Family Cicindelidae, *Cicindela duodecimguttata* Dej. var. *bucolica*, Casey; *Cicindela hirticollis* Say; Family Cambidae, *Bembidion ca inula* Cho.; Family Omophronidae, *Omophron tersalatum* Say; Family Dytiscidae, *Ilybius angustior* Gyll; Family Gyrinidae, *Gyrinus maculiventris*

Lec; Family Silphidae, *Silpha trituberculata* Kby; Family Staphylinidae, *Creophilus marillosus* var. *villosus* Grav; Family Histeridae, *Sup inus fraternus* Say; Family Phalaeridae, *Olib, us semiatricatus* (?) Lec; Family Coccinellidae, *Coccinella perplexa* Muls (?) *trifasciata* L; *Coccinella transversoguttata* Fald; Family Scarabaeidae, *Phyllophaga anxia* Lec (dubia Smith); Family Chrysomelidae, *Callig. apha multipunctata* Say; *Galerucella nymphaeae* L; *Tre habda netidicollis* Lec (larva of this or closely related species—A. O. Bovary, U. S. Nat. Mus.); Family Curculionidae, *Hylobius confusus* Kby.

The tiger beetles *C. histicollis* were seen occasionally on the beach in the bright sun but proved difficult to catch. On July 12th, 13th and 14th they were more plentiful and many pairs were copulating. When disturbed they do not separate but fly together, the male, as far as could be seen, carrying the female. This made the flight slower and the insects more easy to capture. They were not seen so plentifully although July 16th was apparently an ideal day. The species is not at all common in the province and local in its distribution.

The beetles *C. multipunctata* were extremely common on the willow bushes and all stages from eggs to perfect forms were obtained on July 10th. Certain small bushes they entirely stripped of leaves and their choice of species was marked. They attacked mainly *Salix lucida* and *S. discolor*, less frequently *S. longifolia*, and never *S. peltita* or *S. candida*. In one case, even when practically all the leaves of a small *S. lucida* were eaten, they did not attempt to eat those of an *S. candida* the twigs of which were actually mixed with and touching their food plant.

The species *Creophilus villosus* was found entirely in the shed where the fish were cleaned and packed and was quite common there.

Phyllophaga anxia was not taken at first, but during the evening of July 8th large numbers of them were flying about and probably a hundred or two dropped into the camp fire. The next day they were found on the spit, but not at all plentifully. On the evening of the 10th they were again flying in large numbers and fell into the fire. It would appear as if they were in course of migration, for only a very few were found after that date.

It will be noticed that in quite a number of cases the foregoing list of beetles, small though it is, extends the recorded range of most of the species as given by Leng (3).

ORDER HYMENOPTERA.

The following were taken but mostly not well enough preserved for accurate identification.

Larva of a saw-fly Tenthredinidae (E. A. Schwarz, U. S. Nat. Mus.)

Camponotus herculeanus L. (W. M. Mann, U. S. Nat. Mus.)

Nematus crichsoni Htg.; *Bombus* sp.; *Megachile* sp.; *Adrena* sp.; *Sphex fragilis* Sm.; *Sphex uruaria* Dahle; *Chelonus* sp.; *Pteronidea* sp. (S. A. Rohwer, U. S. Nat. Mus.); *Zaleptopygus incompletus* Prov.; *Adiastola* sp. (R. A. Cushman, U. S. Nat. Mus.).

CLASS ARACHNIDA.

Dictyna colupis Keys; *Clubiona riparia* Koch; *Tetragnatha laboriosa* Hentz; *Meta menardi* Latr.; *Epeira trivittata* Keys. (C. R. Shoemaker, U. S. Nat. Mus.)

MOLLUSCA.

Zone L slopes up gradually from the water and the slope is continued in K, but it reaches its apex there and drops slightly before passing over into zone J. In this small inner slope of zone K, particularly at the west end, are groups of the shells of molluscs probably deposited there a year or so before when the lake level was higher. From these the following have been kindly identified by Dr. F. C. Baker of Illinois.

ORDER PULMONATA.

Family Lymnaeidae, *Lymnaea stagnalis appressa* Say; *Galba obrussa decampi* Say; *Galba catascopium* Say; Family Planorbidae, *Planorbis binneyi* Tyron; *Planorbis parvus* Say; Family Physidae, *Physa* sp.; Family Valvatidae, *Valvata sincera* Say; *Valvata lewisii helicordea*, Dall; *Valvata tricarinata* Say.

ORDER EULAMELLIBRANCHIATA.

Family Sphaeriidae, *Sphaerium fabale* Prime.

Some of these were also taken alive but all obviously occur in the water round the spit.

SUMMARY.

Little remains to be added in the way of a summary since the work itself constitutes

a record of the plants and animals obtained. These include at any rate 48 plants belonging to 21 families and 127 animals widely scattered in different classes, besides a number of others not identified; this number, taking into account the small area and the limited time, gives an idea of the possibilities of the district. It represents one stage in the seasonal changes of the spit, since all the actual collecting was done within a day or so and naturally, as the facies of the habitat changes in the passage of the year, the animals will also change not only in their relations to one another and to the plants and to the stage of their life history but also in the actual species present. Some species will remain throughout, others will disappear and yet others will be represented that were not found at the time. Most of the species are probably to be regarded as stable components of the life complex of the spit, but certain forms, such for example as the beetle *Polyphylla anxia*, appear as if they were simply migrants. No doubt more prolonged study would have revealed further species at the time and would certainly have added considerably to the life history of the forms obtained. This interesting spit would well repay more detailed study.

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A FAIRY-SHRIMP NEW TO CANADA AND WESTERN NORTH AMERICA

By FRITS JOHANSEN.

Since my article on Canadian and Alaskan fairy-shrimps was published in the *Canadian Field Naturalist*, February, 1921, I have had the great pleasure of receiving from Mr. and Mrs. T. L. Thacker, of Little Mountain, Hope, B.C., records that they have kept of fairy-shrimps observed and collected in Southern British Columbia, together with samples of the specimens. They prove to be the well-known form *Eubbranchipus vernalis* Verrill, hitherto not recorded from Canada and the United States west of Indiana. In my article cited above I have mentioned this species, pp. 24, 27, as one that possesses a wide distribution in the United States, occurring only during the winter and early spring.

While the genus *Streptocephalus* (see p. 29) was established already by Baird, in 1854, the genus *Eubbranchipus* does not occur outside of North America, and was founded by Verrill, in 1869, in describing *E. vernalis* for the first time.

Mr. Thacker's records of *E. vernalis* from British Columbia follow:

Hope, B.C.: Sloughs in orchard at Little Mountain, through hole in ice, March-April, 1918 (plentiful March 10 and April 1; only one specimen March 13, 24, and April 21, 28). None secured by fishing there on May 26 and June 26, 1918.

Same place, in 1920: none secured on Jan. 18 and Feb. 17; one young on Feb. 22.

Slough at Haig, Feb. 11, 1920; plentiful.

Craigdorroch Gardens, Victoria, Vancouver Island: few females with egg-bags in pond, Feb. 14, 1920.

According to Verrill and Packard this species reaches a length of 23 mm. in both sexes; and in life the body is of a pale flesh colour, with a deep, reddish-brown colour as a narrow streak widening from the genital organs to the posterior half of the abdomen. The hairs upon the cercopods are white, as are also the tips (endites) of the basal part of the foliaceous legs. These red-brown and white colours are the most conspicuous ones when the animal is seen in the water.

The female is easily distinguished from that of *E. gelidus* (see p. 28), by not having the ninth and tenth body-segments produced into lateral processes, though the egg-sac is similar, not so long as broad. The male is also easily distinguished from that of *E. gelidus* by having the frontal (accessory) organs much shorter, broader, and flatter, triangular in shape and acutely pointed, with the edge finely serrated. Except when in use they are hidden by the much longer claspers (2nd pair of antennæ), which have a stout basal joint and a chitinous terminal joint resembling a Turkish sword, with a long obtuse spur on the inner side, basally, beyond which the joint is triangular, with the extremity bent outward somewhat like the foot of a sock before it is worn. These specific characteristics are illustrated in Packard's monograph (1883), Plates XI, XXII.

The nauplii (no figures given) were successfully hatched by the two brothers Hay (*Amer. Natural.*, Vol. 23, 1889, p. 91), (1), from egg-bearing females secured in April, that soon died. The eggs were kept in the dry mud all summer; and when at the end of September they were covered with water, they immediately rose to the surface, remained there for a couple of days, and then again sank to the bottom. In the beginning of October a number of nauplii came forth; they were paler and more transparent than is generally the case with nauplii of fairy-shrimps. Also they seemed to leave the egg in a more advanced stage as a "metanauplius" than other fairy-shrimps (there were traces of the first 3-4 pairs of foliaceous legs, and of the paired eyes), thus recalling the just hatched *Lepidurus* (see p. 45).

This species was first recorded by Gould (*Rep. on Invertebr. of Mass.*, Cambridge, 1841), who states (p. 339) that they are found in stagnant pools in Massachusetts, but wrongly referred them to the European species *Branchipus stagnalis* L. Verrill (*Proc. Am. Ass. Adv. Sc.*, 1869) was the first to call attention to this, describing it as *E. vernalis* and recording it in addition from Connecticut. It has later been found also in Rhode Island. Long

Island, Pennsylvania, Ohio and Indiana (Hay, Notes on Some Freshwater Crustacea, etc., *Amer. Natural.*, Vol. XII, (16); Packard (1883), etc.) The dates upon which it has been observed range there from the middle of November to the middle of May; and from the date available it seems that the eggs hatch when the "dried-up" pools in which they have been deposited become filled with rain-water in the late fall, or with melting-water in the early spring. The larvae then grow to maturity in a month or so, attaining that state in December (January), or April (May), as the case may be. From the new records from British Columbia given here it would appear that their "season" in Western Canada (at least in the mountainous parts) is shorter (say from January to April), beginning later and ending sooner than in eastern United States.

Packard's theory ("Occurrence of the Phyllopod *Eubrachipus* in winter" *Amer. Natural.*, Vol. XII, 1878, p. 186), that it attains maturity in the autumn is not borne out by any observations.

In spite of its frequency during the winter in eastern United States, where it is the most typical fairy-shrimp, no new

(1) In the same paper *E. gelidus* is described for the first time.

data about its biology have been published, so far as I know, for the last thirty years; and we do not yet definitely know the number of broods during the time it occurs there. It is probable that there are two generations, one hatching after the fall-rains, the other after the melting of the snow in the spring.

A hermaphroditic specimen of this species was found by Dr. C. F. Gissler, in January, 1880, in a pool near Maspeth, Long Island, together with many normal individuals of the same species. It is described and figured by him in the *Amer. Naturalist*, Vol. XV., 1881, p. 136-39. In the same volume is another article by Dr. Gissler about the influence of the chemico-physical nature of the particular pond upon the colour and development of the *E. vernalis* it contains; it establishes a red and a white colour-variety which do not cross.

I take this opportunity of correcting a statement I made in these articles (Vol. 35, p. 41). The genus-name *Apus* was established by Schaeffer in 1752, and that of *Lepidurus* by Leach in 1816. The Euphyllopoda were first placed among the insects, before it was recognized that they belonged to true crustaceans.

BIRDS THAT ARE LITTLE KNOWN IN MANITOBA.

BY NORMAN CRIDDLE,

Treesbank, Manitoba.

The following notes are presented in order to record observations relating to some of the rarer birds found within the boundaries of Manitoba. Most of the species have been recorded before, but as they were considered rare at the time of record additional information concerning them seems desirable.

FERRUGINOUS ROUGH-LEGGED HAWK.

Mr. Atkinson in his "Rare Bird Records" (*Trans. No. 65 Historical and Scientific Soc. of Man.*) gives a single record of this species as being the only one known from the province. As a matter of fact the bird is by no means uncommon, and, judging from old nests, it has evi-

dently resided in Manitoba for many years past. Its haunts are very similar to those of the Red-tailed and Swainson's hawks, excepting that it has not been observed to spread over the open prairies as the last named species does. The nests are nearly always distinguishable from other buzzards by their bulkiness, due to the fact that they are added to year after year until eventually they become so abnormally large that they break through their supports or are blown down by the wind. All my nesting records of this hawk were made within, or near, the Spruce Woods Timber Reserve, which is largely made up of low sand hills forming ridges with semi-wooded valleys between.

The Ferruginous Rough-leg is probably the most useful of all our buzzards, its food being made up almost entirely of rodents, of which by far the greater proportion consist of gophers. I have repeatedly seen it carrying off those animals and have found nests inhabited by young containing several untouched examples. It is almost certain that these hawks destroy far more than they can consume when food is abundant, and for this reason a family of these birds might well be estimated to account for a thousand gophers in the course of a season, which, supposing these latter to have been taken from a grain field, would be equal to a saving of five hundred bushels of grain.

This hawk should be better known among the farming community and as a step in that direction I would propose that we discard the cumbersome name that is at present attached to it and call it Rusty Hawk instead.

BURROWING OWL.

This owl has previously been recorded by Mr. Atkinson in the above mentioned publication, and by me in the *Ottawa Naturalist*. It has always been considered a rarity, however, and for that reason additional records of the bird's occurrence are desirable.

During the last three years I have had occasion to travel rather extensively over the western portion of the province, and as a result have run across several breeding pairs of this species. No less than three families were observed near Souris, another was noted near Melita, while odd individuals were seen at Pierson, Napinka and Virden. I have usually found this owl in the vicinity of badger holes with burrows of the prairie gopher (*C. richardsoni*) close around. It probably nests in the former excavations and doubtless uses the gophers as food.

ARKANSAS KINGBIRD.

Whether this bird was overlooked in former days or has extended its range northward within recent times is a question I am not prepared to answer, but it is now found quite commonly in the south-west portion of the province, where it shows a marked preference for human habitations. Nearly every village now

has its pair of breeding birds, and the larger places often contain three or four. Trees around the farm yards are also frequently utilized, and the somewhat quarrelsome notes of the bird are among the first to attract one in the early morning. I have observed this species breeding near Winnipeg, and from there westward, along the C.P.R. main line at Carberry, Oaklake and Virden. It is most commonly met with, however, in the south-west portion of the province within a line drawn from Mawbray to Kirkella.

BLACK-HEADED GROSEBEAK.

On the 30th of May, 1919, I was busy in the laboratory with insect work but with ears on the alert for the notes of any newly arriving bird. The work was interesting, and for that reason I had been but half conscious of an unusual song uttered rather continuously from some nearby trees. I had passed it as being an attempt of a Catbird to mimic the combined efforts of a Rose-breasted Grosbeak and House Sparrow, but eventually awakening to the improbability of this I decided upon a closer investigation and easily obtained a close view of the songster which was perched upon an oak. There could be no mistake under such close scrutiny. A heavy beak, the bright brown of a Towhee, white on the wings and tail and a black head. All were plainly visible. Knowing, however, that a dead bird is demanded by exact science I hesitated whether to go for a gun, but what is a dead bird in comparison with a living one which gives promise of breeding where its kind have not previously been known? To me the evidence was complete, but for the sake of corroboration, I called my brothers Stuart and Talbot to view and note the more striking features, which they did, while the bird sang on unconcernedly.

I had hoped that this visitor would have a mate and that they would make their home amid the woods close by, but he vanished the same evening and I saw and heard him no more.

The cause of this bird's having moved beyond its usual range may have been due to abnormally warm weather combined with a succession of south winds. On the other hand, it is possible that the species really does breed in the extreme southern portion of the province as the song, though

quite distinct, might easily pass as an abnormal one of a Rose-breasted Grosbeak.

DICKCISSEL.

This bird was first recorded for the province by Mr. G. E. Atkinson, who took a specimen near Portage la Prairie on June 14, 1897. He concluded that the example was a straggler from the south, though the date at which it was taken would indicate that it was breeding in the neighborhood.

On June 24, 1921, I was out on grasshopper work in company with Mr. P. N. Vroom. We stopped at Melita and had gone out in the evening to do a little collecting south-west of the village. About half a mile away there is a ravine with stagnant pools of water, and just beyond, to the right, a rather wide dry meadow dotted over with low-lying shrubs consisting of Silverberry (*Elaeagnus argentea*), Western Snowberry (*Symphoricarpos occidentalis*) and a few others in lesser numbers. There is some high herbage, too, which provides abundance of cover for small birds. It was on the edge of this meadow, near the road, that I heard a song with which I was unfamiliar and which I traced to a small bird sitting upon a fence post. We soon obtained a close view of the singer, which I recognized by the characteristic black patch beneath the throat to be a Dickcissel. This was a male in full song and, interestingly enough, his song was answered by a second indi-

vidual about 80 yards away in the same valley. No nests were found or even sought for, but from the fact that there were two or more males singing there, I think we may safely conclude that the species breeds in the vicinity.

LARK BUNTING.

This species ranges east to Aweme, where it has been known to nest. It is, however, but a casual visitor in most parts of the province, though it breeds quite commonly in the extreme south-west corner.

BLACK-THROATED BLUE WARBLER.

Two examples, both males, have been seen since my original record of this species. While these birds were not collected the markings are so distinctive that it would be an extraordinary lack of observation to mistake the species for any other.

MOUNTAIN BLUEBIRD.

It is interesting to relate that this handsome species has taken readily to nesting boxes and that it is steadily increasing. Both this and the common Bluebird have made their nests in the vicinity of my home for some years past, and while the House Sparrow is there, too, and has a reputation for fighting, he is invariably vanquished when he comes in contact with the Bluebirds.

LESSONS LEARNED FROM A TAME SPARROW HAWK.

By P. A. TAVERNER.

(Published by permission of the Director of the Victoria Memorial Museum.)

Some years ago we kept what I was about to call a captive Sparrow Hawk; but the word "captive" conveys an erroneous impression of relationship. "Tame" is weak and equally misleading. Perhaps it is better to make a new start and state that, — once upon a time, I was on intimately friendly terms with a Sparrow Hawk. She had been taken from her deep, dark nest cavity a half grown youngster, inexperienced in the ways of Sparrow Hawks in the wide, wild world; and whatever she afterwards did or thought or attained was more the result of instinct and natural ability developed

through contact with human kind, than of normal Sparrow Hawk education. When I first met her, an adolescent bird, as friend and master, there is reason to suspect that experience with humans had not predisposed her in their favor; but, as events proved, nothing serious enough had happened to prevent the establishment of thorough confidence between us. During the two or three years this charming intimacy endured I had unusual opportunities for studying Sparrow Hawk nature in general and this bird in particular.

Ornithological observers are familiar



FALCO, a tame sparrow-hawk (*falco sparverius*).

with the fact that all wild creatures have certain fixed specific habits and mental reactions to various stimuli. Some species are particularly wary and cautious, others are constitutionally confiding or bold. What we also know but usually realize all too vaguely is that besides these characteristics common to a species, are other mental attitudes that are as strictly individual as many human traits. In watching Falco, as we called her, it was borne in upon us with all the force of a strictly new discovery that the Sparrow Hawks we thought we knew so well are not automata all cast in the same mould, that they each have mentalities of their own, personal habits that change in detail from time to time under whim or passing states of mind, individual likes and dislikes; in fact they have lives of their own to live and minds of their own to live them. Even a field naturalist is apt to acquire the habit of considering the birds he studies in the broad and general, as species and subspecies rather than as individuals. Not the least learned from association with this little hawk was this appreciation of her individual personality.

Next to these evidences of personality the most striking qualities Falco presented were affection, and, if the manner of dealing with unusual conditions is a criterion, her quite considerable intelligence. Though suspicious of strangers, she showed a decided liking for her immediate family, and enjoyed to sit upon our shoulders, fluffed up like a ball cuddling close to the neck and passing her bill delicately around the convolutions of the ear to the accompaniment of a contented little churring note of satisfaction. She knew even the sound of our foot-steps. A stranger's footfall along the concrete sidewalk leading to the outer door drove her precipitately to her safe citadel on top of her seldom occupied cage in the far upper corner of the room. The sounds of our steps on the same walk merely caused a look of expectation and a preparation to alight upon our shoulders as soon as we appeared. She recognized paper parcels as common containers of meat and showed interest in them accordingly. She knew that water could be obtained at the sink through our mediation, and came to it

when thirsty or wanting a bath. She recognized doors as the means of communication between rooms and when lonely and wanting to join us, came to them and scratched and churred for admission. A mirror perplexed her once but, finding nothing behind, she had no interest in it afterwards.

At times she was playful and enjoyed a certain game in which a long yellow pencil (no other color served quite as well) was pointed at her. On finally gaining possession of it she would brandish it most cleverly with feet and bill until it slipped to the floor, when she would look down, as if in surprise, and descend to obtain it again. She had many mimic fights with her distorted reflection in the curved base of a brass lamp, would hide from it behind books or obstructions, then pounce from ambush, striking vigorously with her feet and uttering low churs of pleasure.

Though nervous with strangers, especially men, she showed a surprising lack of appreciation of danger from hereditary or natural enemies, showing that fear of definite objects is not as instinctive as is commonly believed. A strange face at the window caused her to flee in terror, but I have seen her sit with only interested curiosity on the window sill within, whilst without a cat struggled to make through the glass at her. A dog was only an interesting phenomenon to her, nothing more.

Once a cigar box, with a hole in the side like a bird box, was prepared and hung near her usual perch. She was interested at once, and hardly was it fixed than she was peering in. She entered, and for the next little while nothing was seen of her except occasional glimpses of her bright little face looking out, but from within could be heard the sounds of scratching, thumping and excited ejaculation. Thereafter she spent many minutes, aggregating hours perhaps per day, in the box, always in an excited condition. It was evident that latent sexual instincts were aroused, and feeling half guilty at having raised unsatisfiable desires we removed the box.

In spite of the unnaturalness of the circumstances surrounding her she appeared content and happy, except for short

periods twice a year — early spring and late fall. In the spring, before the sap had stirred on the sunniest slopes, and whilst snow seemed the eternal order of things, and the season's advance was only to be noted by the calendar, she became restless and discontented. It was the "Season of New Song"; more, it was also, it seemed, the season of migration, and whether she knew the meaning of it or not something stirred within her in consequence and she was deeply moved. Normally serene and contented in her window, watching with bright, interested eyes all that passed within her ken, then she was restless and excited, pattering back and forth along the narrow runway of her window meeting-rail, pausing at intervals to half-raise her wings and chatter loudly the well-known Sparrow Hawk cry of agitation. Once at such a time I saw a wild Sparrow Hawk pass over without. She saw it too, for little escaped her piercing eyes. She followed it with her gaze from the time it first hove in sight, leaning against the glass to see around the window jamb until it passed from sight behind some trees. This condition lasted but a little while each season, a couple of weeks perhaps, but while it lasted it was nearly as hard on us, her friends, as upon herself. Shortly she was her old self again, content to watch the world go by from her observatory window, her only agitation the butcher's or grocer's boy that brought her food and sent her seeking safety to the high top of her empty cage. Similar disturbances to the even tenor of her way occurred in the fall. As the first frosts loosed the leaves and the grasshoppers were dropping numbed from the yellowing grass whence wild Sparrow Hawks had but lately gleaned them, nature stirred again within her. Its meaning I do not think she ever definitely recognized, but she became again uneasy, restless and difficult to please.

Now, neither before nor during these periods were there any perceptible changes in the conditions under which she lived. She was not reactive to differences or shortage of food, temperature or any other factor that could be humanly recognized. The change came from within, rather than from without. I think that as fruit and foliage grow through the season, in cer-

tain times ripen to maturity and then decline in metabolic activity, so the migrating and sexual instincts develop, culminate and decline in measured growth but slightly accelerated or retarded by variations in seasonal condition. And thus birds feel the urge to migrate, and depart in the fall before the lack of food, the ultimate necessity for such a movement, has sapped their energies and vigor. In the spring it works the other way; the onward urge toward a harder rather than a softer climate comes early, and they tread upon the very footsteps of winter, arriving north at the earliest moment that existence for their kind is measureably secure, to the end that they have the greatest length of season in which to raise their families to migrational maturity before the return of winter.

One of Falco's interesting physical characteristics was her comparative independence of water. She was fed principally on butcher's meat. When liver, English Sparrows or other moist meat formed a fair proportion of her food, water was only desired for bathing, and sometimes weeks went by without her drinking. After a spell of rather dry meat she desired water and asked for it in a way that we who knew her little idiosyncracies recognized perfectly. She enjoyed bathing, and splashed the water from her bowl far and wide, retiring afterwards to her sunny window to dry and fluff. As said before, her food was largely, and of necessity, from the butcher's shop, and when English Sparrows grew too wary to be readily obtained, it was found necessary occasionally to mix a little chopped tow or shredded rope end with it to supply the roughage for natural digestion and the pellet for regurgitation. She invariably avoided fat, tearing it from the lean in little shreds and impatiently discarding it. She also appreciated a variety in diet, and changes from beef to pork or mutton or back again always met with her approval. At times she even tired of English Sparrows and became satiated with her favorite tit-bits, June-bugs or Grasshoppers. It is evident then that birds enjoy a variety of foods, and no matter how plentiful some one supply may become, at times they will turn their attention elsewhere to balance

out the ration. This trait undoubtedly extends the usefulness of each species of birds and at the same time explains why, in time of great insect plagues, birds are not engaged in eating them to the exclusion of less abundant food. Some variety is desirable if not an absolute necessity to them.

The quickness of some of *Falco*'s reactions were remarkable. An extreme example can be presented. She slept on the top of her cage, canary-like, with her head under her wing as it is generally described, although really the head is hidden under the interseapular feathers between the shoulders.

Wishing to obtain a photograph of her in this attitude a camera was set conveniently, and late at night, when she was sound asleep, an explosive magnesium flash was fired. Of course she awoke immediately, but the speed of her movement was only appreciated when the resultant negative was developed. It presented two clear superimposed images without blur between. One showed her asleep with only a slight depression in the feather masses where the head was hidden; in the other she was wide awake regarding the light. What the duration of the flash was I had no means of telling; it was surely but a small fraction of a second, yet during this short period she had held her pose long enough to make a sensible impression on the plate. She had awakened, changed her position so quickly that the movement made no blur, and again held her position long enough to register another picture.

Falco had the habit of "caching" superfluous food. She did this from the first, and in so business-like and natural a manner that I am convinced that it was instinctive and is a regular specific habit. I have seen no suggestion to this in the literature relating to the wild bird. This case may not prove beyond question that wild Sparrow Hawks do hide stores, but it is strongly suggestive of its probability. When hunger was temporarily satisfied, the unconsumed remainder of the supplies was invariably carried in the bill to one of several usual hiding places. The most favored one was on top of the electric meter on the wall nearby. She would place the valued bit in the depression be-

tween the top of the meter and the wall, and stamp it down with her feet in a business-like manner, churring with a note of exultation and then withdrawing to view results. If not satisfied she would return and rearrange and hammer it again and when satisfied seek her perch. Any time thereafter a motion on our part towards her store would arouse anxious interest, and if the threatened theft were pressed she was immediately on hand to protect her property. Even if the attempt



a. — Normal falcon bill.

b. — Overgrown falcon bill, showing tendency of growth and loosening scale.

c. — Normal Buteo bill.

did not seem serious, after a minute she often made an investigation and even changed the hiding place. When hungry again she remembered her hidden store and, if it had been removed unbeknown to her, showed disappointment and perplexity most plainly.

Perhaps from a strictly scientific standpoint the most interesting discovery made from this little bird was the method of growth of her bill. The Sparrow Hawk, though small, is a true Falcon, a "Noble Falcon" in the old vocabulary of venery. The bill of this group of raptorial birds is distinguished from the less esteemed hawks by having a distinct notch and tooth on the cutting edge of the upper mandible just back of the hook. This tooth therefore is an important point in the classification of the order. *Falco* lived largely on soft meat, and her bill without the natural friction and wear and tear against the hard bony parts of normal prey overgrew. When this occurred the notch forming the tooth became almost obliterated, and the bill tended to resemble the form and character of the non-falconine hawks with a smoothly outlined lobe on the cutting edge. When this abnormal condition became well developed, and it seemed as if a falcon was about to assume a Buteo or Accipiter character, a crack

developed in the bill substance and grew until a flake of horn flew off, leaving the falconian notch fully developed again.

The significance of this is rather important as it indicates that the tooth-billed hawks are more highly developed than the others and appeared later in the evolutionary scheme; that the "Noble" is a specialized "Ignoble Hawk" instead of the contrary. It is, in fact, additional justification for contemporary classifications placing the Falcons at the head of their order.

Falco had a considerable measure of freedom, and seldom except for good reason was confined to her cage. When the robins without would leave her in peace and some one was about to ward

off cats she even had the run of the yard. Had she allowed her primaries to mature she might have had absolute freedom at any time. She always managed to break them off before full grown and was in a half flightless condition unequipped to fend for herself. Season after season passed in various attempts on our part to keep her wings in order, to prepare her for a fair fight with the world. Whether we succeeded in the end we do not know, but that is another story.

All told, little Falco was a most pleasing experience in the life of an ornithologist and we still remember her with affection, regretting that such happy associations cannot continue indefinitely.

NOTES AND OBSERVATIONS.

UNUSUAL MIGRATION RECORDS IN THE VICINITY OF MONTREAL. — MARCH 1921.

No doubt the mild weather during the past winter, and the abundance of fruit and seeds (especially coniferous seeds) limited the movements of a great many Northern birds. Throughout South-Eastern Canada and the North-Eastern States, at least in urban districts, the dearth of birds appears to have been general. Of the customary winter birds the following were seen in the vicinity of Montreal in very small numbers: Snow Owl (2); Saw-whet Owl (2); Hairy and Downy Woodpeckers; Snow Bunting; White-winged Crossbill; Pine Siskin; Goldfinch; Redpoll; Cedar Waxwing; White-breasted Nuthatch; Red-breasted Nuthatch; Black-capped Chickadee.

The unusual occurrences were: Herring Gull (last seen Jan. 15); Canada Goose (Magog, Jan. 16—N. Smith); and Robin (4) seen by Mr. Brown on Jan. 30. There were several other reports of Robins that I was unable to verify — one from St. Lambert, another from Westmount and a third from St. Andrews East. It is notable that the only unusual birds were north of their usual winter range. I have no records of Evening Grosbeaks, Bohemian Waxwings or Pine Grosbeaks. With regard to the latter I am told that they have wintered commonly in Newfoundland.

During January and February I saw

no ducks whatever, possibly due to the many areas of open water. As a rule, in the vicinity of St. Lambert, wintering ducks are congested within a small area of open water, and are easily seen. Following is a list of spring arrivals during the month of March. The earlier birds — Crow and Prairie Horned Lark, were late, while the others, almost without exception, were very early. I have taken the liberty of including several records secured by Mr. W. J. Brown, and one by Miss E. Luke.

- March 2—Crow.
- March 4—Prairie Horned Lark.
- March 5—Flock (15) of Robins on a sheltered southern slope, two Meadowlarks and a Red-shouldered Hawk, all seen by Mr. Brown.
- March 9—Song Sparrow (39 'song').
- March 11—Red-winged Blackbird (35 males, 'song'); House Wren—one seen in a sheltered garden by Mr. Brown.
- March 12—Bronzed Grackle — 6 seen (Mr. Brown); Bluebird — three 'song'.
- March 13—Marsh Hawk — one; Robins and Song Sparrows fairly common.
- March 1 —Slate-coloured Junco — one (Miss Luke).
- March 19—Canada Goose — one flock; Purple Finch—7 (Mr. Brown).

March 20—Northern Shrike — one; Her-ring Gull — one.

March 22—Golden-eye Duck—two flocks.

March 25—Black Duck — three pairs; Bittern — one; Sparrow Hawk — one; Flicker — one; Gold-finch — 5 or 6; Tree Sparrow — a number; Killdeer Plover—7 seen and two nest excavations found; Bluebirds fairly well distributed — 8 seen; a Crow's nest was found almost completed, and Robins were found exceptionally abundant.

March 26—Rose-breasted Grosbeak — one male (Mr. Brown); Cowbird — one.

March 27—Goshawk—one; Migrant Shrike — two; Vesper Sparrow — one (Mr. Brown).

Besides the unusual records enumerated above there are two matters worthy of particular mention — the unusual abundance of Robins and Black Ducks. I assume that Black Ducks are unusually abundant this season because I saw three pairs about some marshy, partly wooded land, where formerly it was customary for but one pair to nest. It is an easy matter to distinguish ducks that have arrived on their nesting grounds. They are always in pairs and the drake appears never to let his spouse out of sight, or perhaps it is the other way about. The individuals of a pair fly in perfect 'step' and appear as a unit.

Possibly the consistently favourable weather during the nesting season last spring is partly responsible for this apparent increase, and very probably the vigilance of officers in enforcing observance of the Migratory Birds Convention Act has much to do with it.

L. McI. TERRILL.

A PINE SISKIN INVASION. — In Central Alberta, the Pine Siskin (*Spinus pinus*) has generally been considered an irregular migrant, except in a few favorable localities where they remain to breed in small numbers. As they are frequenters of the coniferous woods, especially during the nesting season, these birds are not commonly seen in the settled parts of the country, the spruce, tamarack and

jack pine not growing on the better soils of the prairie.

About the middle of June, this year, I noticed numbers of siskins flying over Camrose, and eventually found them feeding on dandelion seeds on the lawns and boulevards. Their numbers increased daily, and about a week after their first appearance I estimated that at least five hundred of the birds were making their home in town. At almost any hour during the day, large flocks could be seen flying high in the air, whirling here and there in Red Poll fashion, sometimes alighting on a vacant lot, feeding for a while, and off again as suddenly as they came. I have counted as many as one hundred on the telephone wires between two poles, which appeared to be favorite resting places for the birds.

The siskins' appearance this summer was not local by any means. During the months of June, July and August, I motored several hundred miles, and found them quite common in some, and exceedingly common in many of the places through which I passed. They were plentiful in Edmonton, noticed all the way to Calgary, and not nearly as many at Banff and Lake Louise, where one would expect to find them in greatest abundance. This makes one ask if it is not possible that they had left their natural haunts for some reason. I also found them very common at Vermilion, Tofield, Stettler and Castor. At this date, September 15th, there are about one thousand birds in Camrose, and they are now feeding on the pig-weed seed.

As all the points mentioned above (except those in the mountains) are in the park country of the prairie, where there are no evergreens, save small patches along the river bottoms, it seems strange that these birds should have made this unusual migration. As the siskin is an early breeder, nesting in May, it is safe to assume that the birds that have been on the prairies since the middle of June were old ones and the increase of the year. It would be interesting to know if this unusual appearance of the siskin has occurred over the whole prairie country and the reason for this decided change in habitat.

F. L. FARLEY, Camrose, Alberta.

SOME MOSSES FROM BOSKUNG.

As botanical field work in Canada at the present day is largely confined to flowering plants, a few amateur notes on Ontario mosses may perhaps be forgiven by the small omniscient experts to whom my findings must seem elementary and superficial.

In the month of August, 1921, I spent a two weeks vacation on the shores of Boskung Lake, Stanhope township, Haliburton county, Ontario. By way of diversion, I attempted to take a census of the mosses of the immediate neighborhood. The completed census-roll, though limited, may not be without interest.

Boskung Lake is a small, pear-shaped body of water, lying wholly within the rough, granitic Laurentian Pene-plain. Its surface is some 1100 feet above sea-level and its shores rise steeply to an additional height of from 100 to 150 feet. Its narrow watershed contains no bogs, swamps, or small streams. The soil is morainic sand.

The possibilities of the field were thus distinctly limited, and the various mosses which favor limestones, which grow at low levels and in warm climates, and which flourish in bogs, in water, or on clay soil, conspicuously lacking. With these reservations, however, my brief survey found many species and much encouragement.

The chief soil-loving mosses were the Common Hair-cap, the glaucous-green Juniper Hair-cap, the muddy-green Common Barbula, the Common Bryum, the Crested Fissidens, and the Maidenhair-like Fissidens.

Frequent finds in moist woods were the Common Fern Moss, the Smaller Fern Moss, and the Woodsy Mnium. The Clavellate Drummondia was common on the bark of trees; while the Slender Plagiotheceum and the Aduate Amblystegium were found about their bases. Rotten wood was upholstered with dense mats of the bright green Common Hypnum, the Pinnate Hypnum, the slender Creeping Amblystegium, the Creeping Hypnum, the Nodding Bryum, and the Ribbed Hypnum. Around old stumps I found the European Tree Moss, not unlike a small Lycopod, and the dark, thin mats of the Purple Ceratodon.

At the head of Boskung Lake, Hall's Rapids, a short but violent stream foams down from a higher lake to the north, drenching its rocky ravine with spray. Here were soft, wet masses of the Beaked Anomodon, the Slender Anomodon, the Bristly Rhacomitrium, the Long-Leaved Mnium, the Fountain Philonotis, and the Verdant Weissia.

A final hunting-ground was a steep granite cliff, caused by a colossal fault in the rocks around the entire northeast shore of the lake and kept moist at its base by a thick mantle of forest. Small, dark tufts of Common Grimmia were the first discovery; then came the dark, brittle masses of the Rock-loving Andreaea, the flattened branches of the filmy-fern Homalia, and the delicate little Wiry Fern Moss; and then the Yew-leaved Fissidens, the Small-capsuled Rhacomitrium, the Long-capsuled Brachythecium, and the Crispate Ptychomitrium.

Some 34 different species of moss were thus identified, with more or less dubious accuracy. Several other specimens were collected, but for them identification was impossible with the two hand-lenses, of 9 and 24 diameters respectively, with which I was equipped.

The record is a small one, but surely large enough, when we consider the limitations of time, season, and physiography in this individual case, to suggest real possibilities for amateur bryological work in Ontario.

WATSON KIRKCONNELL, M. A.

BIRDS AS FOSTER PARENTS. — It is not generally known, probably, that wild birds will assume the role of foster parents, but after a number of tests the writer has discovered that there are a few birds at least that will take up these duties under certain conditions. Firstly the orphan birds must be quite young, and, secondly, the foster parents must have young of their own about the same age. I have exchanged the young of crows, pigeons, swallows and sparrows, and in every instance they were raised to maturity. This was done when the young were in the downy stage and all were about the same age, but if a more mature bird be introduced into a nest of downy

young he would be promptly ejected or left to starve. It seems that the maternal and paternal love of birds is the strongest at this period, which might account for their taking more readily to the young of others. While the fostering of the above-mentioned species was in the main brought about through human agency and not on their own volition, yet it has been my good fortune to observe a few cases of strictly voluntary adoption.

One of the most interesting cases of this kind was that of a pair of Killdeer Plover. In the spring of 1919 a young man brought to my shop a pair of these birds to have mounted with their young ones which he had caught after shooting their parents. As these birds had been shot at close range while protecting their young, they were too much cut up for mounting, so I prevailed on the young man to give me the young orphans to release, which he did. It seemed to me that perhaps I could get them adopted by a pair of Killdeers which I knew had young, and occupied a field about half a mile distant. With this end in view, I forthwith picked up the box of little orphans and made a bee-line for that field, but after criss-crossing the field several times, I failed to locate them and was becoming discouraged. I then walked to the centre of the field, sat on a stone and took the perforated cover off the box. They stretched up their little necks and gave utterance in unison to a very low plaintive cry or pipe. Almost immediately, like a bolt from the clear sky, the female Killdeer flew towards me and settled about 25 yards distant. She had heard their piping cry and came to rescue. She appeared to be in great distress and anxiety. When the little ones heard her voice they also became agitated and raised their little voices, which brought the mother bird almost to my feet uttering most bewailing lamentations. Then I took one of the little orphans from the box and set it on my hand. The scene which followed was very pathetic. She seemed to go into paroxysms of grief, and with most lamentable cries and wings and tail outspread, quite fearless of me, she ran around me at a distance of not

more than 15 or 20 feet. She would drag herself on her breast as though both her legs were broken, then roll over on her back struggling as though she was tied down; hop along on one leg with wings drooping; turn summersaults and put herself into all manner of shapes. Obviously these manoeuvres were to entice me to chase her and get me away from the young ones.

Not caring to keep her in further suspense I set the little fellow down, and he ran over to her as fast as his little legs could carry him. She advanced a little to meet him throwing one wing over him, and uttering a most affectionate purring or crooning sound of joy and satisfaction, something akin to that of a mother cat when you take her kitten from her to fondle. I now released the other three and they likewise made direct for this foster mother, and she slowly led them away until I lost sight of them in the grass. Had they been her own, and she must have known they were not, she could not have shown more maternal love and affection. The male bird the while kept up his plaintive pee-we-we-we-we-we-we-we, but did not come so close, and I feel certain kept his eye on their own little flock. I am satisfied that these foster parents raised these little orphans, as, passing through the field again in August I counted nine on the wing, and I am absolutely certain that these were the only pair of Killdeer that nested in that field or vicinity that year.

OLIVER TRAFFORD,
St. Eugene, Ont.

WHITE-RUMPED SANDPIPER AT OTTAWA.
— Two white-rumped sandpipers (*Pisobia fuscicollis*) were noted at Shirley's Bay, near Ottawa, on October 8, 1921. They were in company with some black-bellied plovers and solitary and other sandpipers, and the difference between the white-rumped species and the others was quite plain as a result of the conspicuous white upper tail coverts. A specimen was collected to make identification certain. The only available authority stated that this bird has only been noted on three occasions in this locality.

PHILIP F. FORAN.

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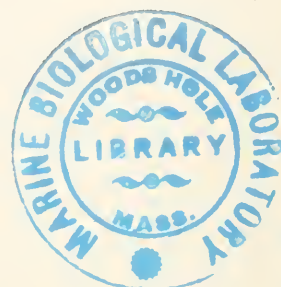
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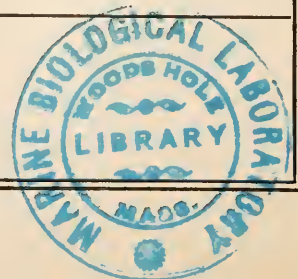
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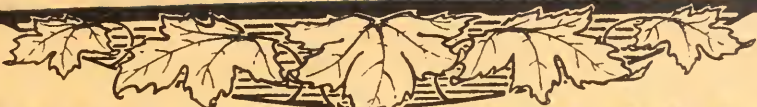
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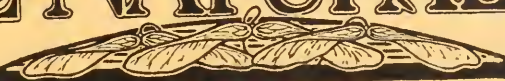
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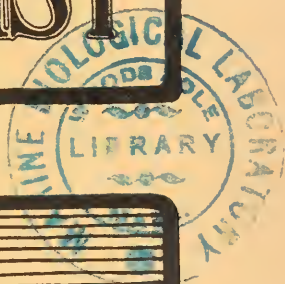
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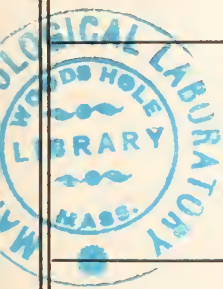
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